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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>6</sup> : <b>C12N 15/31, C07K 14/315, 16/12, C12Q 1/68</b>	<b>A2</b>	(11) International Publication Number: <b>WO 98/18931</b>
		(43) International Publication Date: 7 May 1998 (07.05.98)

(21) International Application Number: PCT/US97/19588

(22) International Filing Date: 30 October 1997 (30.10.97)

(30) Priority Data:  
60/029,960 31 October 1996 (31.10.96) US

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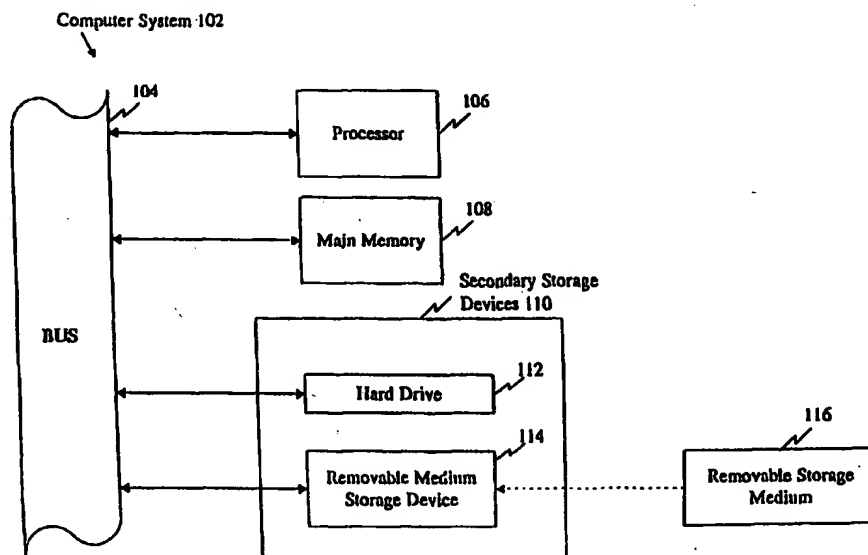
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(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

**Published**

Without international search report and to be republished upon receipt of that report.

(54) Title: *STREPTOCOCCUS PNEUMONIAE* POLYNUCLEOTIDES AND SEQUENCES**(57) Abstract**

The present invention provides polynucleotide sequences of the genome of *Streptococcus pneumoniae*, polypeptide sequences encoded by the polynucleotide sequences, corresponding polynucleotides and polypeptides, vectors and hosts comprising the polynucleotides, and assays and other uses thereof. The present invention further provides polynucleotide and polypeptide sequence information stored on computer readable media, and computer-based systems and methods which facilitate its use.

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## *Streptococcus pneumoniae* Polynucleotides and Sequences

### FIELD OF THE INVENTION

5       The present invention relates to the field of molecular biology. In particular, it relates to, among other things, nucleotide sequences of *Streptococcus pneumoniae*, contigs, ORFs, fragments, probes, primers and related polynucleotides thereof, peptides and polypeptides encoded by the sequences, and uses of the polynucleotides and sequences thereof, such as in fermentation,  
10   polypeptide production, assays and pharmaceutical development, among others.

### BACKGROUND OF THE INVENTION

*Streptococcus pneumoniae* has been one of the most extensively studied  
15   microorganisms since its first isolation in 1881. It was the object of many investigations that led to important scientific discoveries. In 1928, Griffith observed that when heat-killed encapsulated pneumococci and live strains constitutively lacking any capsule were concomitantly injected into mice, the nonencapsulated could be converted into encapsulated pneumococci with the same  
20   capsular type as the heat-killed strain. Years later, the nature of this "transforming principle," or carrier of genetic information, was shown to be DNA. (Avery, O.T., et al., *J. Exp. Med.*, 79:137-157 (1944)).

      In spite of the vast number of publications on *S. pneumoniae* many questions about its virulence are still unanswered, and this pathogen remains a  
25   major causative agent of serious human disease, especially community-acquired pneumonia. (Johnston, R.B., et al., *Rev. Infect. Dis.* 13(Suppl. 6):S509-517 (1991)). In addition, in developing countries, the pneumococcus is responsible for the death of a large number of children under the age of 5 years from pneumococcal pneumonia. The incidence of pneumococcal disease is highest in infants under 2  
30   years of age and in people over 60 years of age. Pneumococci are the second most frequent cause (after *Haemophilus influenzae* type b) of bacterial meningitis and otitis media in children. With the recent introduction of conjugate vaccines for *H. influenzae* type b, pneumococcal meningitis is likely to become increasingly prominent. *S. pneumoniae* is the most important etiologic agent of community-

acquired pneumonia in adults and is the second most common cause of bacterial meningitis behind *Neisseria meningitidis*.

The antibiotic generally prescribed to treat *S. pneumoniae* is benzylpenicillin, although resistance to this and to other antibiotics is found occasionally. Pneumococcal resistance to penicillin results from mutations in its penicillin-binding proteins. In uncomplicated pneumococcal pneumonia caused by a sensitive strain, treatment with penicillin is usually successful unless started too late. Erythromycin or clindamycin can be used to treat pneumonia in patients hypersensitive to penicillin, but resistant strains to these drugs exist. Broad spectrum antibiotics (e.g., the tetracyclines) may also be effective, although tetracycline-resistant strains are not rare. In spite of the availability of antibiotics, the mortality of pneumococcal bacteremia in the last four decades has remained stable between 25 and 29%. (Gillespie, S.H., *et al.*, *J. Med. Microbiol.* 28:237-248 (1989).

*S. pneumoniae* is carried in the upper respiratory tract by many healthy individuals. It has been suggested that attachment of pneumococci is mediated by a disaccharide receptor on fibronectin, present on human pharyngeal epithelial cells. (Anderson, B.J., *et al.*, *J. Immunol.* 142:2464-2468 (1989). The mechanisms by which pneumococci translocate from the nasopharynx to the lung, thereby causing pneumonia, or migrate to the blood, giving rise to bacteremia or septicemia, are poorly understood. (Johnston, R.B., *et al.*, *Rev. Infect. Dis.* 13(Suppl. 6):S509-517 (1991).

Various proteins have been suggested to be involved in the pathogenicity of *S. pneumoniae*, however, only a few of them have actually been confirmed as virulence factors. Pneumococci produce an IgA1 protease that might interfere with host defense at mucosal surfaces. (Kornfield, S.J., *et al.*, *Rev. Inf. Dis.* 3:521-534 (1981). *S. pneumoniae* also produces neuraminidase, an enzyme that may facilitate attachment to epithelial cells by cleaving sialic acid from the host glycolipids and gangliosides. Partially purified neuraminidase was observed to induce meningitis-like symptoms in mice; however, the reliability of this finding has been questioned because the neuraminidase preparations used were probably contaminated with cell wall products. Other pneumococcal proteins besides neuraminidase are involved in the adhesion of pneumococci to epithelial and endothelial cells. These pneumococcal proteins have as yet not been identified. Recently, Cundell *et al.*, reported that peptide permeases can modulate

pneumococcal adherence to epithelial and endothelial cells. It was, however, unclear whether these permeases function directly as adhesions or whether they enhance adherence by modulating the expression of pneumococcal adhesions. (DeVelasco, E.A., *et al.*, *Micro. Rev.* 59:591-603 (1995). A better understanding of the virulence factors determining its pathogenicity will need to be developed to cope with the devastating effects of pneumococcal disease in humans.

Ironically, despite the prominent role of *S. pneumoniae* in the discovery of DNA, little is known about the molecular genetics of the organism. The *S. pneumoniae* genome consists of one circular, covalently closed, double-stranded DNA and a collection of so-called variable accessory elements, such as prophages, plasmids, transposons and the like. Most physical characteristics and almost all of the genes of *S. pneumoniae* are unknown. Among the few that have been identified, most have not been physically mapped or characterized in detail. Only a few genes of this organism have been sequenced. (See, for instance current versions of GENBANK and other nucleic acid databases, and references that relate to the genome of *S. pneumoniae* such as those set out elsewhere herein.)

It is clear that the etiology of diseases mediated or exacerbated by *S. pneumoniae*, infection involves the programmed expression of *S. pneumoniae* genes, and that characterizing the genes and their patterns of expression would add dramatically to our understanding of the organism and its host interactions. Knowledge of *S. pneumoniae* genes and genomic organization would improve our understanding of disease etiology and lead to improved and new ways of preventing, ameliorating, arresting and reversing diseases. Moreover, characterized genes and genomic fragments of *S. pneumoniae* would provide reagents for, among other things, detecting, characterizing and controlling *S. pneumoniae* infections. There is a need to characterize the genome of *S. pneumoniae* and for polynucleotides of this organism.

### SUMMARY OF THE INVENTION

5 The present invention is based on the sequencing of fragments of the *Streptococcus pneumoniae* genome. The primary nucleotide sequences which were generated are provided in SEQ ID NOS:1-391.

10 The present invention provides the nucleotide sequence of several hundred contigs of the *Streptococcus pneumoniae* genome, which are listed in tables below and set out in the Sequence Listing submitted herewith, and representative fragments thereof, in a form which can be readily used, analyzed, and interpreted by a skilled artisan. In one embodiment, the present invention is provided as contiguous strings of primary sequence information corresponding to the nucleotide sequences depicted in SEQ ID NOS:1-391.

15 The present invention further provides nucleotide sequences which are at least 95% identical to the nucleotide sequences of SEQ ID NOS:1-391.

20 The nucleotide sequence of SEQ ID NOS:1-391, a representative fragment thereof, or a nucleotide sequence which is at least 95% identical to the nucleotide sequence of SEQ ID NOS:1-391 may be provided in a variety of mediums to facilitate its use. In one application of this embodiment, the sequences of the present invention are recorded on computer readable media. Such media includes, but is not limited to: magnetic storage media, such as floppy discs, hard disc storage medium, and magnetic tape; optical storage media such as CD-ROM; electrical storage media such as RAM and ROM; and hybrids of these categories such as magnetic/optical storage media.

25 The present invention further provides systems, particularly computer-based systems which contain the sequence information herein described stored in a data storage means. Such systems are designed to identify commercially important fragments of the *Streptococcus pneumoniae* genome.

30 Another embodiment of the present invention is directed to fragments of the *Streptococcus pneumoniae* genome having particular structural or functional attributes. Such fragments of the *Streptococcus pneumoniae* genome of the present invention include, but are not limited to, fragments which encode peptides, hereinafter referred to as open reading frames or ORFs, fragments which modulate the expression of an operably linked ORF, hereinafter referred to as expression  
35 modulating fragments or EMFs, and fragments which can be used to diagnose the

presence of *Streptococcus pneumoniae* in a sample, hereinafter referred to as diagnostic fragments or DFs.

Each of the ORFs in fragments of the *Streptococcus pneumoniae* genome disclosed in Tables 1-3, and the EMFs found 5' to the ORFs, can be used in numerous ways as polynucleotide reagents. For instance, the sequences can be used as diagnostic probes or amplification primers for detecting or determining the presence of a specific microbe in a sample, to selectively control gene expression in a host and in the production of polypeptides, such as polypeptides encoded by ORFs of the present invention, particular those polypeptides that have a pharmacological activity.

The present invention further includes recombinant constructs comprising one or more fragments of the *Streptococcus pneumoniae* genome of the present invention. The recombinant constructs of the present invention comprise vectors, such as a plasmid or viral vector, into which a fragment of the *Streptococcus pneumoniae* has been inserted.

The present invention further provides host cells containing any of the isolated fragments of the *Streptococcus pneumoniae* genome of the present invention. The host cells can be a higher eukaryotic host cell, such as a mammalian cell, a lower eukaryotic cell, such as a yeast cell, or a procaryotic cell such as a bacterial cell.

The present invention is further directed to isolated polypeptides and proteins encoded by ORFs of the present invention. A variety of methods, well known to those of skill in the art, routinely may be utilized to obtain any of the polypeptides and proteins of the present invention. For instance, polypeptides and proteins of the present invention having relatively short, simple amino acid sequences readily can be synthesized using commercially available automated peptide synthesizers. Polypeptides and proteins of the present invention also may be purified from bacterial cells which naturally produce the protein. Yet another alternative is to purify polypeptide and proteins of the present invention from cells which have been altered to express them.

The invention further provides methods of obtaining homologs of the fragments of the *Streptococcus pneumoniae* genome of the present invention and homologs of the proteins encoded by the ORFs of the present invention. Specifically, by using the nucleotide and amino acid sequences disclosed herein as

a probe or as primers, and techniques such as PCR cloning and colony/plaque hybridization, one skilled in the art can obtain homologs.

The invention further provides antibodies which selectively bind polypeptides and proteins of the present invention. Such antibodies include both  
5 monoclonal and polyclonal antibodies.

The invention further provides hybridomas which produce the above-described antibodies. A hybridoma is an immortalized cell line which is capable of secreting a specific monoclonal antibody.

The present invention further provides methods of identifying test samples  
10 derived from cells which express one of the ORFs of the present invention, or a homolog thereof. Such methods comprise incubating a test sample with one or more of the antibodies of the present invention, or one or more of the DFs of the present invention, under conditions which allow a skilled artisan to determine if the sample contains the ORF or product produced therefrom.

15 In another embodiment of the present invention, kits are provided which contain the necessary reagents to carry out the above-described assays.

Specifically, the invention provides a compartmentalized kit to receive, in close confinement, one or more containers which comprises: (a) a first container comprising one of the antibodies, or one of the DFs of the present invention; and  
20 (b) one or more other containers comprising one or more of the following: wash reagents, reagents capable of detecting presence of bound antibodies or hybridized DFs.

Using the isolated proteins of the present invention, the present invention further provides methods of obtaining and identifying agents capable of binding to  
25 a polypeptide or protein encoded by one of the ORFs of the present invention. Specifically, such agents include, as further described below, antibodies, peptides, carbohydrates, pharmaceutical agents and the like. Such methods comprise steps of: (a) contacting an agent with an isolated protein encoded by one of the ORFs of the present invention; and (b) determining whether the agent binds to said protein.

30 The present genomic sequences of *Streptococcus pneumoniae* will be of great value to all laboratories working with this organism and for a variety of commercial purposes. Many fragments of the *Streptococcus pneumoniae* genome will be immediately identified by similarity searches against GenBank or protein databases and will be of immediate value to *Streptococcus pneumoniae* researchers

and for immediate commercial value for the production of proteins or to control gene expression.

The methodology and technology for elucidating extensive genomic sequences of bacterial and other genomes has and will greatly enhance the ability to  
5 analyze and understand chromosomal organization. In particular, sequenced contigs and genomes will provide the models for developing tools for the analysis of chromosome structure and function, including the ability to identify genes within large segments of genomic DNA, the structure, position, and spacing of regulatory  
10 elements, the identification of genes with potential industrial applications, and the ability to do comparative genomic and molecular phylogeny.

### DESCRIPTION OF THE FIGURES

**FIGURE 1** is a block diagram of a computer system (102) that can be  
15 used to implement computer-based systems of present invention.

**FIGURE 2** is a schematic diagram depicting the data flow and computer programs used to collect, assemble, edit and annotate the contigs of the *Streptococcus pneumoniae* genome of the present invention. Both Macintosh and  
20 Unix platforms are used to handle the AB 373 and 377 sequence data files, largely as described in Kerlavage *et al.*, *Proceedings of the Twenty-Sixth Annual Hawaii International Conference on System Sciences*, 585, IEEE Computer Society Press, Washington D.C. (1993). Factura (AB) is a Macintosh program designed for automatic vector sequence removal and end-trimming of sequence files. The  
25 program Loadis runs on a Macintosh platform and parses the feature data extracted from the sequence files by Factura to the Unix based *Streptococcus pneumoniae* relational database. Assembly of contigs (and whole genome sequences) is accomplished by retrieving a specific set of sequence files and their associated features using Extrseq, a Unix utility for retrieving sequences from an SQL  
30 database. The resulting sequence file is processed by seq\_filter to trim portions of the sequences with more than 2% ambiguous nucleotides. The sequence files were assembled using TIGR Assembler, an assembly engine designed at The Institute for Genomic Research ( TIGR ) for rapid and accurate assembly of thousands of sequence fragments. The collection of contigs generated by the assembly step is  
35 loaded into the database with the lassie program. Identification of open reading

frames (ORFs) is accomplished by processing contigs with zorf or GenMark. The ORFs are searched against *S. pneumoniae* sequences from GenBank and against all protein sequences using the BLASTN and BLASTP programs, described in Altschul *et al.*, *J. Mol. Biol.* 215: 403-410 (1990)). Results of the ORF  
5 determination and similarity searching steps were loaded into the database. As described below, some results of the determination and the searches are set out in Tables 1-3.

### DETAILED DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

10

The present invention is based on the sequencing of fragments of the *Streptococcus pneumoniae* genome and analysis of the sequences. The primary nucleotide sequences generated by sequencing the fragments are provided in SEQ ID NOS:1-391. (As used herein, the "primary sequence" refers to the nucleotide  
15 sequence represented by the IUPAC nomenclature system.)

In addition to the aforementioned *Streptococcus pneumoniae* polynucleotide and polynucleotide sequences, the present invention provides the nucleotide sequences of SEQ ID NOS:1-391, or representative fragments thereof, in a form which can be readily used, analyzed, and interpreted by a skilled artisan.

20 As used herein, a "representative fragment of the nucleotide sequence depicted in SEQ ID NOS:1-391" refers to any portion of the SEQ ID NOS:1-391 which is not presently represented within a publicly available database. Preferred representative fragments of the present invention are *Streptococcus pneumoniae* open reading frames ( ORFs ), expression modulating fragment ( EMFs ) and  
25 fragments which can be used to diagnose the presence of *Streptococcus pneumoniae* in sample ( DFs ). A non-limiting identification of preferred representative fragments is provided in Tables 1-3. As discussed in detail below, the information provided in SEQ ID NOS:1-391 and in Tables 1-3 together with routine cloning, synthesis, sequencing and assay methods will enable those skilled  
30 in the art to clone and sequence all "representative fragments" of interest, including open reading frames encoding a large variety of *Streptococcus pneumoniae* proteins.

While the presently disclosed sequences of SEQ ID NOS:1-391 are highly accurate, sequencing techniques are not perfect and, in relatively rare instances,  
35 further investigation of a fragment or sequence of the invention may reveal a



nucleotide sequence error present in a nucleotide sequence disclosed in SEQ ID NOS:1-391. However, once the present invention is made available (*i.e.*, once the information in SEQ ID NOS:1-391 and Tables 1-3 has been made available), resolving a rare sequencing error in SEQ ID NOS:1-391 will be well within the skill of the art. The present disclosure makes available sufficient sequence information to allow any of the described contigs or portions thereof to be obtained readily by straightforward application of routine techniques. Further sequencing of such polynucleotide may proceed in like manner using manual and automated sequencing methods which are employed ubiquitous in the art. Nucleotide sequence editing software is publicly available. For example, Applied Biosystem's (AB) AutoAssembler can be used as an aid during visual inspection of nucleotide sequences. By employing such routine techniques potential errors readily may be identified and the correct sequence then may be ascertained by targeting further sequencing effort, also of a routine nature, to the region containing the potential error.

Even if all of the very rare sequencing errors in SEQ ID NOS:1-391 were corrected, the resulting nucleotide sequences would still be at least 95% identical, nearly all would be at least 99% identical, and the great majority would be at least 99.9% identical to the nucleotide sequences of SEQ ID NOS:1-391.

As discussed elsewhere herein, polynucleotides of the present invention readily may be obtained by routine application of well known and standard procedures for cloning and sequencing DNA. Detailed methods for obtaining libraries and for sequencing are provided below, for instance. A wide variety of *Streptococcus pneumoniae* strains that can be used to prepare *S. pneumoniae* genomic DNA for cloning and for obtaining polynucleotides of the present invention are available to the public from recognized depository institutions, such as the American Type Culture Collection (ATCC). While the present invention is enabled by the sequences and other information herein disclosed, the *S. pneumoniae* strain that provided the DNA of the present Sequence Listing, Strain 7/87 14.8.91, has been deposited in the ATCC, as a convenience to those of skill in the art. As a further convenience, a library of *S. pneumoniae* genomic DNA, derived from the same strain, also has been deposited in the ATCC. The *S. pneumoniae* strain was deposited on October 10, 1996, and was given Deposit No. 55840, and the cDNA library was deposited on October 11, 1996 and was given Deposit No. 97755. The genomic fragments in the library are 15 to 20 kb

fragments generated by partial Sau3A1 digestion and they are inserted into the BamHI site in the well-known lambda-derived vector lambda DASH II (Stratagene, La Jolla, CA). The provision of the deposits is not a waiver of any rights of the inventors or their assignees in the present subject matter.

5       The nucleotide sequences of the genomes from different strains of *Streptococcus pneumoniae* differ somewhat. However, the nucleotide sequences of the genomes of all *Streptococcus pneumoniae* strains will be at least 95% identical, in corresponding part, to the nucleotide sequences provided in SEQ ID NOS:1-391. Nearly all will be at least 99% identical and the great majority will be  
10   99.9% identical.

Thus, the present invention further provides nucleotide sequences which are at least 95%, preferably 99% and most preferably 99.9% identical to the nucleotide sequences of SEQ ID NOS:1-391, in a form which can be readily used, analyzed and interpreted by the skilled artisan.

15       Methods for determining whether a nucleotide sequence is at least 95%, at least 99% or at least 99.9% identical to the nucleotide sequences of SEQ ID NOS:1-391 are routine and readily available to the skilled artisan. For example, the well known fasta algorithm described in Pearson and Lipman, *Proc. Natl. Acad. Sci. USA* 85: 2444 (1988) can be used to generate the percent identity of nucleotide  
20   sequences. The BLASTN program also can be used to generate an identity score of polynucleotides compared to one another.

#### COMPUTER RELATED EMBODIMENTS

25       The nucleotide sequences provided in SEQ ID NOS:1-391, a representative fragment thereof, or a nucleotide sequence at least 95%, preferably at least 99% and most preferably at least 99.9% identical to a polynucleotide sequence of SEQ ID NOS:1-391 may be "provided" in a variety of mediums to facilitate use thereof. As used herein, provided refers to a manufacture, other than an isolated nucleic acid molecule, which contains a nucleotide sequence of the present invention; *i.e.*,  
30   a nucleotide sequence provided in SEQ ID NOS:1-391, a representative fragment thereof, or a nucleotide sequence at least 95%, preferably at least 99% and most preferably at least 99.9% identical to a polynucleotide of SEQ ID NOS:1-391. Such a manufacture provides a large portion of the *Streptococcus pneumoniae* genome and parts thereof (*e.g.*, a *Streptococcus pneumoniae* open reading frame  
35   (ORF)) in a form which allows a skilled artisan to examine the manufacture using

means not directly applicable to examining the *Streptococcus pneumoniae* genome or a subset thereof as it exists in nature or in purified form.

In one application of this embodiment, a nucleotide sequence of the present invention can be recorded on computer readable media. As used herein, "computer readable media" refers to any medium which can be read and accessed directly by a computer. Such media include, but are not limited to: magnetic storage media, such as floppy discs, hard disc storage medium, and magnetic tape; optical storage media such as CD-ROM; electrical storage media such as RAM and ROM; and hybrids of these categories; such as magnetic/optical storage media. A skilled artisan can readily appreciate how any of the presently known computer readable mediums can be used to create a manufacture comprising computer readable medium having recorded thereon a nucleotide sequence of the present invention. Likewise, it will be clear to those of skill how additional computer readable media that may be developed also can be used to create analogous manufactures having recorded thereon a nucleotide sequence of the present invention.

As used herein, "recorded" refers to a process for storing information on computer readable medium. A skilled artisan can readily adopt any of the presently know methods for recording information on computer readable medium to generate manufactures comprising the nucleotide sequence information of the present invention. A variety of data storage structures are available to a skilled artisan for creating a computer readable medium having recorded thereon a nucleotide sequence of the present invention. The choice of the data storage structure will generally be based on the means chosen to access the stored information. In addition, a variety of data processor programs and formats can be used to store the nucleotide sequence information of the present invention on computer readable medium. The sequence information can be represented in a word processing text file, formatted in commercially-available software such as WordPerfect and MicroSoft Word, or represented in the form of an ASCII file, stored in a database application, such as DB2, Sybase, Oracle, or the like. A skilled artisan can readily adapt any number of data-processor structuring formats (e.g., text file or database) in order to obtain computer readable medium having recorded thereon the nucleotide sequence information of the present invention.

Computer software is publicly available which allows a skilled artisan to access sequence information provided in a computer readable medium. Thus, by providing in computer readable form the nucleotide sequences of SEQ ID NOS:1-

391, a representative fragment thereof, or a nucleotide sequence at least 95%, preferably at least 99% and most preferably at least 99.9% identical to a sequence of SEQ ID NOS:1-391 the present invention enables the skilled artisan routinely to access the provided sequence information for a wide variety of purposes.

5       The examples which follow demonstrate how software which implements the BLAST (Altschul *et al.*, *J. Mol. Biol.* 215:403-410 (1990)) and BLAZE (Brutlag *et al.*, *Comp. Chem.* 17:203-207 (1993)) search algorithms on a Sybase system was used to identify open reading frames (ORFs) within the *Streptococcus pneumoniae* genome which contain homology to ORFs or proteins from both  
10 *Streptococcus pneumoniae* and from other organisms. Among the ORFs discussed herein are protein encoding fragments of the *Streptococcus pneumoniae* genome useful in producing commercially important proteins, such as enzymes used in fermentation reactions and in the production of commercially useful metabolites.

      The present invention further provides systems, particularly computer-  
15 based systems, which contain the sequence information described herein. Such systems are designed to identify, among other things, commercially important fragments of the *Streptococcus pneumoniae* genome.

      As used herein, "a computer-based system" refers to the hardware means, software means, and data storage means used to analyze the nucleotide sequence  
20 information of the present invention. The minimum hardware means of the computer-based systems of the present invention comprises a central processing unit (CPU), input means, output means, and data storage means. A skilled artisan can readily appreciate that any one of the currently available computer-based systems are suitable for use in the present invention.

25       As stated above, the computer-based systems of the present invention comprise a data storage means having stored therein a nucleotide sequence of the present invention and the necessary hardware means and software means for supporting and implementing a search means.

      As used herein, "data storage means" refers to memory which can store  
30 nucleotide sequence information of the present invention, or a memory access means which can access manufactures having recorded thereon the nucleotide sequence information of the present invention.

      As used herein, "search means" refers to one or more programs which are implemented on the computer-based system to compare a target sequence or target  
35 structural motif with the sequence information stored within the data storage

means. Search means are used to identify fragments or regions of the present genomic sequences which match a particular target sequence or target motif. A variety of known algorithms are disclosed publicly and a variety of commercially available software for conducting search means are and can be used in the computer-based systems of the present invention. Examples of such software includes, but is not limited to, MacPattern (EMBL), BLASTN and BLASTX (NCBIA). A skilled artisan can readily recognize that any one of the available algorithms or implementing software packages for conducting homology searches can be adapted for use in the present computer-based systems.

As used herein, a "target sequence" can be any DNA or amino acid sequence of six or more nucleotides or two or more amino acids. A skilled artisan can readily recognize that the longer a target sequence is, the less likely a target sequence will be present as a random occurrence in the database. The most preferred sequence length of a target sequence is from about 10 to 100 amino acids or from about 30 to 300 nucleotide residues. However, it is well recognized that searches for commercially important fragments, such as sequence fragments involved in gene expression and protein processing, may be of shorter length.

As used herein, "a target structural motif," or "target motif," refers to any rationally selected sequence or combination of sequences in which the sequence(s) are chosen based on a three-dimensional configuration which is formed upon the folding of the target motif. There are a variety of target motifs known in the art. Protein target motifs include, but are not limited to, enzymic active sites and signal sequences. Nucleic acid target motifs include, but are not limited to, promoter sequences, hairpin structures and inducible expression elements (protein binding sequences).

A variety of structural formats for the input and output means can be used to input and output the information in the computer-based systems of the present invention. A preferred format for an output means ranks fragments of the *Streptococcus pneumoniae* genomic sequences possessing varying degrees of homology to the target sequence or target motif. Such presentation provides a skilled artisan with a ranking of sequences which contain various amounts of the target sequence or target motif and identifies the degree of homology contained in the identified fragment.

A variety of comparing means can be used to compare a target sequence or target motif with the data storage means to identify sequence fragments of the

*Streptococcus pneumoniae* genome. In the present examples, implementing software which implement the BLAST and BLAZE algorithms, described in Altschul *et al.*, *J. Mol. Biol.* 215: 403-410 (1990), is used to identify open reading frames within the *Streptococcus pneumoniae* genome. A skilled artisan can readily  
5 recognize that any one of the publicly available homology search programs can be used as the search means for the computer-based systems of the present invention. Of course, suitable proprietary systems that may be known to those of skill also may be employed in this regard.

Figure 1 provides a block diagram of a computer system illustrative of  
10 embodiments of this aspect of present invention. The computer system 102 includes a processor 106 connected to a bus 104. Also connected to the bus 104 are a main memory 108 (preferably implemented as random access memory, RAM) and a variety of secondary storage devices 110, such as a hard drive 112 and a removable medium storage device 114. The removable medium storage device 114  
15 may represent, for example, a floppy disk drive, a CD-ROM drive, a magnetic tape drive, *etc.* A removable storage medium 116 (such as a floppy disk, a compact disk, a magnetic tape, *etc.*) containing control logic and/or data recorded therein may be inserted into the removable medium storage device 114. The computer system 102 includes appropriate software for reading the control logic and/or the  
20 data from the removable medium storage device 114, once it is inserted into the removable medium storage device 114.

A nucleotide sequence of the present invention may be stored in a well known manner in the main memory 108, any of the secondary storage devices 110, and/or a removable storage medium 116. During execution, software for accessing  
25 and processing the genomic sequence (such as search tools, comparing tools, *etc.*) reside in main memory 108, in accordance with the requirements and operating parameters of the operating system, the hardware system and the software program or programs.

## BIOCHEMICAL EMBODIMENTS

Other embodiments of the present invention are directed to isolated fragments of the *Streptococcus pneumoniae* genome. The fragments of the  
5 *Streptococcus pneumoniae* genome of the present invention include, but are not limited to fragments which encode peptides and polypeptides, hereinafter open reading frames (ORFs), fragments which modulate the expression of an operably linked ORF, hereinafter expression modulating fragments (EMFs) and fragments which can be used to diagnose the presence of *Streptococcus pneumoniae* in a  
10 sample, hereinafter diagnostic fragments (DFs).

As used herein, an "isolated nucleic acid molecule" or an "isolated fragment of the *Streptococcus pneumoniae* genome" refers to a nucleic acid molecule possessing a specific nucleotide sequence which has been subjected to purification means to reduce, from the composition, the number of compounds which are  
15 normally associated with the composition. Particularly, the term refers to the nucleic acid molecules having the sequences set out in SEQ ID NOS:1-391, to representative fragments thereof as described above, to polynucleotides at least 95%, preferably at least 99% and especially preferably at least 99.9% identical in sequence thereto, also as set out above.

20 A variety of purification means can be used to generate the isolated fragments of the present invention. These include, but are not limited to methods which separate constituents of a solution based on charge, solubility, or size.

In one embodiment, *Streptococcus pneumoniae* DNA can be enzymatically sheared to produce fragments of 15-20 kb in length. These fragments can then be  
25 used to generate a *Streptococcus pneumoniae* library by inserting them into lambda clones as described in the Examples below. Primers flanking, for example, an ORF, such as those enumerated in Tables 1-3 can then be generated using nucleotide sequence information provided in SEQ ID NOS:1-391. Well known and routine techniques of PCR cloning then can be used to isolate the ORF from  
30 the lambda DNA library or *Streptococcus pneumoniae* genomic DNA. Thus, given the availability of SEQ ID NOS:1-391, the information in Tables 1, 2 and 3, and the information that may be obtained readily by analysis of the sequences of SEQ ID NOS:1-391 using methods set out above, those of skill will be enabled by the present disclosure to isolate any ORF-containing or other nucleic acid fragment of  
35 the present invention.

The isolated nucleic acid molecules of the present invention include, but are not limited to single stranded and double stranded DNA, and single stranded RNA.

As used herein, an "open reading frame," ORF, means a series of triplets coding for amino acids without any termination codons and is a sequence translatable into protein.

Tables 1, 2, and 3 list ORFs in the *Streptococcus pneumoniae* genomic contigs of the present invention that were identified as putative coding regions by the GeneMark software using organism-specific second-order Markov probability transition matrices. It will be appreciated that other criteria can be used, in accordance with well known analytical methods, such as those discussed herein, to generate more inclusive, more restrictive, or more selective lists.

Table 1 sets out ORFs in the *Streptococcus pneumoniae* contigs of the present invention that over a continuous region of at least 50 bases are 95% or more identical (by BLAST analysis) to a nucleotide sequence available through GenBank in October, 1997.

Table 2 sets out ORFs in the *Streptococcus pneumoniae* contigs of the present invention that are not in Table 1 and match, with a BLASTP probability score of 0.01 or less, a polypeptide sequence available through GenBank in October, 1997.

Table 3 sets out ORFs in the *Streptococcus pneumoniae* contigs of the present invention that do not match significantly, by BLASTP analysis, a polypeptide sequence available through GenBank in October, 1997.

In each table, the first and second columns identify the ORF by, respectively, contig number and ORF number within the contig; the third column indicates the first nucleotide of the ORF (actually the first nucleotide of the stop codon immediately preceeding the ORF), counting from the 5' end of the contig strand; and the fourth column, "stop (nt)" indicates the last nucleotide of the stop codon defining the 3' end of the ORF.

In Tables 1 and 2, column five, lists the Reference for the closest matching sequence available through GenBank. These reference numbers are the databases entry numbers commonly used by those of skill in the art, who will be familiar with their denominators. Descriptions of the nomenclature are available from the National Center for Biotechnology Information. Column six in Tables 1 and 2 provides the gene name of the matching sequence; column seven provides the BLAST identity score and column eight the BLAST similarity score from the



comparison of the ORF and the homologous gene; and column nine indicates the length in nucleotides of the highest scoring segment pair identified by the BLAST identity analysis.

Each ORF described in the tables is defined by "start (nt)" (5') and "stop (nt)" (3') nucleotide position numbers. These position numbers refer to the boundaries of each ORF and provide orientation with respect to whether the forward or reverse strand is the coding strand and which reading frame the coding sequence is contained. The "start" position is the first nucleotide of the triplet encoding a stop codon just 5' to the ORF and the "stop" position is the last nucleotide of the triplet encoding the next in-frame stop codon (i.e., the stop codon at the 3' end of the ORF). Those of ordinary skill in the art appreciate that preferred fragments within each ORF described in the table include fragments of each ORF which include the entire sequence from the delineated "start" and "stop" positions excepting the first and last three nucleotides since these encode stop codons. Thus, polynucleotides set out as ORFs in the tables but lacking the three (3) 5' nucleotides and the three (3) 3' nucleotides are encompassed by the present invention. Those of skill also appreciate that particularly preferred are fragments within each ORF that are polynucleotide fragments comprising polypeptide coding sequence. As defined herein, "coding sequence" includes the fragment within an ORF beginning at the first in-frame ATG (triplet encoding methionine) and ending with the last nucleotide prior to the triplet encoding the 3' stop codon. Preferred are fragments comprising the entire coding sequence and fragments comprising the entire coding sequence, excepting the coding sequence for the N-terminal methionine. Those of skill appreciate that the N-terminal methionine is often removed during post-translational processing and that polynucleotides lacking the ATG can be used to facilitate production of N-terminal fusion proteins which may be beneficial in the production or use of genetically engineered proteins. Of course, due to the degeneracy of the genetic code many polynucleotides can encode a given polypeptide. Thus, the invention further includes polynucleotides comprising a nucleotide sequence encoding a polypeptide sequence itself encoded by the coding sequence within an ORF described in Tables 1-3 herein. Further, polynucleotides at least 95%, preferably at least 99% and especially preferably at least 99.9% identical in sequence to the foregoing polynucleotides, are contemplated by the present invention.

Polypeptides encoded by polynucleotides described above and elsewhere herein are also provided by the present invention as are polypeptide comprising an amino acid sequence at least about 95%, preferably at least 97% and even more preferably 99% identical to the amino acid sequence of a polypeptide encoded by an ORF shown in Tables 1-3. These polypeptides may or may not comprise an N-terminal methionine.

The concepts of percent identity and percent similarity of two polypeptide sequences is well understood in the art. For example, two polypeptides 10 amino acids in length which differ at three amino acid positions (*e.g.*, at positions 1, 3 and 5) are said to have a percent identity of 70%. However, the same two polypeptides would be deemed to have a percent similarity of 80% if, for example at position 5, the amino acids moieties, although not identical, were "similar" (*i.e.*, possessed similar biochemical characteristics). Many programs for analysis of nucleotide or amino acid sequence similarity, such as *fasta* and *BLAST* specifically list percent identity of a matching region as an output parameter. Thus, for instance, Tables 1 and 2 herein enumerate the percent identity of the highest scoring segment pair in each ORF and its listed relative. Further details concerning the algorithms and criteria used for homology searches are provided below and are described in the pertinent literature highlighted by the citations provided below.

It will be appreciated that other criteria can be used to generate more inclusive and more exclusive listings of the types set out in the tables. As those of skill will appreciate, narrow and broad searches both are useful. Thus, a skilled artisan can readily identify ORFs in contigs of the *Streptococcus pneumoniae* genome other than those listed in Tables 1-3, such as ORFs which are overlapping or encoded by the opposite strand of an identified ORF in addition to those ascertainable using the computer-based systems of the present invention.

As used herein, an "expression modulating fragment," EMF, means a series of nucleotide molecules which modulates the expression of an operably linked ORF or EMF.

As used herein, a sequence is said to "modulate the expression of an operably linked sequence" when the expression of the sequence is altered by the presence of the EMF. EMFs include, but are not limited to, promoters, and promoter modulating sequences (inducible elements). One class of EMFs are  
5 fragments which induce the expression of an operably linked ORF in response to a specific regulatory factor or physiological event.

EMF sequences can be identified within the contigs of the *Streptococcus pneumoniae* genome by their proximity to the ORFs provided in Tables 1-3. An intergenic segment, or a fragment of the intergenic segment, from about 10 to 200  
10 nucleotides in length, taken from any one of the ORFs of Tables 1-3 will modulate the expression of an operably linked ORF in a fashion similar to that found with the naturally linked ORF sequence. As used herein, an "intergenic segment" refers to fragments of the *Streptococcus pneumoniae* genome which are between two ORF(s) herein described. EMFs also can be identified using known EMFs as a  
15 target sequence or target motif in the computer-based systems of the present invention. Further, the two methods can be combined and used together.

The presence and activity of an EMF can be confirmed using an EMF trap vector. An EMF trap vector contains a cloning site linked to a marker sequence. A marker sequence encodes an identifiable phenotype, such as antibiotic resistance or  
20 a complementing nutrition auxotrophic factor, which can be identified or assayed when the EMF trap vector is placed within an appropriate host under appropriate conditions. As described above, a EMF will modulate the expression of an operably linked marker sequence. A more detailed discussion of various marker sequences is provided below. A sequence which is suspected as being an EMF is  
25 cloned in all three reading frames in one or more restriction sites upstream from the marker sequence in the EMF trap vector. The vector is then transformed into an appropriate host using known procedures and the phenotype of the transformed host is examined under appropriate conditions. As described above, an EMF will modulate the expression of an operably linked marker sequence.

30 As used herein, a "diagnostic fragment," DF, means a series of nucleotide molecules which selectively hybridize to *Streptococcus pneumoniae* sequences. DFs can be readily identified by identifying unique sequences within contigs of the *Streptococcus pneumoniae* genome, such as by using well-known computer analysis software, and by generating and testing probes or amplification primers

consisting of the DF sequence in an appropriate diagnostic format which determines amplification or hybridization selectivity.

The sequences falling within the scope of the present invention are not limited to the specific sequences herein described, but also include allelic and species variations thereof. Allelic and species variations can be routinely determined by comparing the sequences provided in SEQ ID NOS:1-391, a representative fragment thereof, or a nucleotide sequence at least 95%, preferably at least 99% and most at least preferably 99.9% identical to SEQ ID NOS:1-391, with a sequence from another isolate of the same species. Furthermore, to accommodate codon variability, the invention includes nucleic acid molecules coding for the same amino acid sequences as do the specific ORFs disclosed herein. In other words, in the coding region of an ORF, substitution of one codon for another which encodes the same amino acid is expressly contemplated. Any specific sequence disclosed herein can be readily screened for errors by resequencing a particular fragment, such as an ORF, in both directions (*i.e.*, sequence both strands). Alternatively, error screening can be performed by sequencing corresponding polynucleotides of *Streptococcus pneumoniae* origin isolated by using part or all of the fragments in question as a probe or primer.

Preferred DFs of the present invention comprise at least about 17, preferably at least about 20, and more preferably at least about 50 contiguous nucleotides within an ORF set out in Tables 1-3. Most highly preferred DFs specifically hybridize to a polynucleotide containing the sequence of the ORF from which they are derived. Specific hybridization occurs even under stringent conditions defined elsewhere herein.

Each of the ORFs of the *Streptococcus pneumoniae* genome disclosed in Tables 1, 2 and 3, and the EMFs found 5' to the ORFs, can be used as polynucleotide reagents in numerous ways. For example, the sequences can be used as diagnostic probes or diagnostic amplification primers to detect the presence of a specific microbe in a sample, particularly *Streptococcus pneumoniae*. Especially preferred in this regard are ORFs such as those of Table 3, which do not match previously characterized sequences from other organisms and thus are most likely to be highly selective for *Streptococcus pneumoniae*. Also particularly preferred are ORFs that can be used to distinguish between strains of *Streptococcus pneumoniae*, particularly those that distinguish medically important strain, such as drug-resistant strains.

In addition, the fragments of the present invention, as broadly described, can be used to control gene expression through triple helix formation or antisense DNA or RNA, both of which methods are based on the binding of a polynucleotide sequence to DNA or RNA. Triple helix-formation optimally results in a shut-off of RNA transcription from DNA, while antisense RNA hybridization blocks translation of an mRNA molecule into polypeptide. Information from the sequences of the present invention can be used to design antisense and triple helix-forming oligonucleotides. Polynucleotides suitable for use in these methods are usually 20 to 40 bases in length and are designed to be complementary to a region of the gene involved in transcription, for triple-helix formation, or to the mRNA itself, for antisense inhibition. Both techniques have been demonstrated to be effective in model systems, and the requisite techniques are well known and involve routine procedures. Triple helix techniques are discussed in, for example, Lee *et al.*, *Nucl. Acids Res.* 6:3073 (1979); Cooney *et al.*, *Science* 241:456 (1988); and Dervan *et al.*, *Science* 251:1360 (1991). Antisense techniques in general are discussed in, for instance, Okano, *J. Neurochem.* 56:560 (1991) and *Oligodeoxynucleotides as Antisense Inhibitors of Gene Expression*, CRC Press, Boca Raton, FL (1988).

The present invention further provides recombinant constructs comprising one or more fragments of the *Streptococcus pneumoniae* genomic fragments and contigs of the present invention. Certain preferred recombinant constructs of the present invention comprise a vector, such as a plasmid or viral vector, into which a fragment of the *Streptococcus pneumoniae* genome has been inserted, in a forward or reverse orientation. In the case of a vector comprising one of the ORFs of the present invention, the vector may further comprise regulatory sequences, including for example, a promoter, operably linked to the ORF. For vectors comprising the EMFs of the present invention, the vector may further comprise a marker sequence or heterologous ORF operably linked to the EMF.

Large numbers of suitable vectors and promoters are known to those of skill in the art and are commercially available for generating the recombinant constructs of the present invention. The following vectors are provided by way of example. Useful bacterial vectors include phagescript, PsiX174, pBluescript SK, pBS KS, pNH8a, pNH16a, pNH18a, pNH46a (available from Stratagene); pTrc99A, pKK223-3, pKK233-3, pDR540, pRIT5 (available from Pharmacia). Useful eukaryotic vectors include pWLneo, pSV2cat, pOG44, pXT1, pSG

(available from Stratagene) pSVK3, pBPV, pMSG, pSVL (available from Pharmacia).

Promoter regions can be selected from any desired gene using CAT (chloramphenicol transferase) vectors or other vectors with selectable markers.

5 Two appropriate vectors are pKK232-8 and pCM7. Particular named bacterial promoters include lacI, lacZ, T3, T7, gpt, lambda PR, and trc. Eukaryotic promoters include CMV immediate early, HSV thymidine kinase, early and late SV40, LTRs from retrovirus, and mouse metallothionein- I. Selection of the appropriate vector and promoter is well within the level of ordinary skill in the art.

10 The present invention further provides host cells containing any one of the isolated fragments of the *Streptococcus pneumoniae* genomic fragments and contigs of the present invention, wherein the fragment has been introduced into the host cell using known methods. The host cell can be a higher eukaryotic host cell, such as a mammalian cell, a lower eukaryotic host cell, such as a yeast cell, or  
15 a procaryotic cell, such as a bacterial cell.

A polynucleotide of the present invention, such as a recombinant construct comprising an ORF of the present invention, may be introduced into the host by a variety of well established techniques that are standard in the art, such as calcium phosphate transfection, DEAE, dextran mediated transfection and electroporation,  
20 which are described in, for instance, Davis, L. *et al.*, BASIC METHODS IN MOLECULAR BIOLOGY (1986).

A host cell containing one of the fragments of the *Streptococcus pneumoniae* genomic fragments and contigs of the present invention, can be used in conventional manners to produce the gene product encoded by the isolated  
25 fragment (in the case of an ORF) or can be used to produce a heterologous protein under the control of the EMF. The present invention further provides isolated polypeptides encoded by the nucleic acid fragments of the present invention or by degenerate variants of the nucleic acid fragments of the present invention. By "degenerate variant" is intended nucleotide fragments which differ  
30 from a nucleic acid fragment of the present invention (*e.g.*, an ORF) by nucleotide sequence but, due to the degeneracy of the Genetic Code, encode an identical polypeptide sequence.

Preferred nucleic acid fragments of the present invention are the ORFs and subfragments thereof depicted in Tables 2 and 3 which encode proteins.

A variety of methodologies known in the art can be utilized to obtain any one of the isolated polypeptides or proteins of the present invention. At the simplest level, the amino acid sequence can be synthesized using commercially available peptide synthesizers. This is particularly useful in producing small peptides and fragments of larger polypeptides. Such short fragments as may be obtained most readily by synthesis are useful, for example, in generating antibodies against the native polypeptide, as discussed further below.

In an alternative method, the polypeptide or protein is purified from bacterial cells which naturally produce the polypeptide or protein. One skilled in the art can readily employ well-known methods for isolating polypeptides and proteins to isolate and purify polypeptides or proteins of the present invention produced naturally by a bacterial strain, or by other methods. Methods for isolation and purification that can be employed in this regard include, but are not limited to, immunochromatography, HPLC, size-exclusion chromatography, ion-exchange chromatography, and immuno-affinity chromatography.

The polypeptides and proteins of the present invention also can be purified from cells which have been altered to express the desired polypeptide or protein. As used herein, a cell is said to be altered to express a desired polypeptide or protein when the cell, through genetic manipulation, is made to produce a polypeptide or protein which it normally does not produce or which the cell normally produces at a lower level. Those skilled in the art can readily adapt procedures for introducing and expressing either recombinant or synthetic sequences into eukaryotic or prokaryotic cells in order to generate a cell which produces one of the polypeptides or proteins of the present invention.

Any host/vector system can be used to express one or more of the ORFs of the present invention. These include, but are not limited to, eukaryotic hosts such as HeLa cells, CV-1 cell, COS cells, and Sf9 cells, as well as prokaryotic host such as *E. coli* and *B. subtilis*. The most preferred cells are those which do not normally express the particular polypeptide or protein or which expresses the polypeptide or protein at low natural level.

"Recombinant," as used herein, means that a polypeptide or protein is derived from recombinant (*e.g.*, microbial or mammalian) expression systems. "Microbial" refers to recombinant polypeptides or proteins made in bacterial or fungal (*e.g.*, yeast) expression systems. As a product, "recombinant microbial" defines a polypeptide or protein essentially free of native endogenous substances and unaccompanied by associated native glycosylation. Polypeptides or proteins expressed in most bacterial cultures, *e.g.*, *E. coli*, will be free of glycosylation modifications; polypeptides or proteins expressed in yeast will have a glycosylation pattern different from that expressed in mammalian cells.

"Nucleotide sequence" refers to a heteropolymer of deoxyribonucleotides. Generally, DNA segments encoding the polypeptides and proteins provided by this invention are assembled from fragments of the *Streptococcus pneumoniae* genome and short oligonucleotide linkers, or from a series of oligonucleotides, to provide a synthetic gene which is capable of being expressed in a recombinant transcriptional unit comprising regulatory elements derived from a microbial or viral operon.

Recombinant expression vehicle or vector" refers to a plasmid or phage or virus or vector, for expressing a polypeptide from a DNA (RNA) sequence. The expression vehicle can comprise a transcriptional unit comprising an assembly of (1) a genetic regulatory elements necessary for gene expression in the host, including elements required to initiate and maintain transcription at a level sufficient for suitable expression of the desired polypeptide, including, for example, promoters and, where necessary, an enhancer and a polyadenylation signal; (2) a structural or coding sequence which is transcribed into mRNA and translated into protein, and (3) appropriate signals to initiate translation at the beginning of the desired coding region and terminate translation at its end. Structural units intended for use in yeast or eukaryotic expression systems preferably include a leader sequence enabling extracellular secretion of translated protein by a host cell. Alternatively, where recombinant protein is expressed without a leader or transport sequence, it may include an N-terminal methionine residue. This residue may or may not be subsequently cleaved from the expressed recombinant protein to provide a final product.

"Recombinant expression system" means host cells which have stably integrated a recombinant transcriptional unit into chromosomal DNA or carry the recombinant transcriptional unit extra chromosomally. The cells can be prokaryotic or eukaryotic. Recombinant expression systems as defined herein will express



heterologous polypeptides or proteins upon induction of the regulatory elements linked to the DNA segment or synthetic gene to be expressed.

Mature proteins can be expressed in mammalian cells, yeast, bacteria, or other cells under the control of appropriate promoters. Cell-free translation systems can also be employed to produce such proteins using RNAs derived from the DNA constructs of the present invention. Appropriate cloning and expression vectors for use with prokaryotic and eukaryotic hosts are described in Sambrook *et al.*, *Molecular Cloning: A Laboratory Manual*, 2<sup>nd</sup> Edition, Cold Spring Harbor Laboratory Press, Cold Spring Harbor, New York (1989), the disclosure of which is hereby incorporated by reference in its entirety.

Generally, recombinant expression vectors will include origins of replication and selectable markers permitting transformation of the host cell, *e.g.*, the ampicillin resistance gene of *E. coli* and *S. cerevisiae* TRP1 gene, and a promoter derived from a highly expressed gene to direct transcription of a downstream structural sequence. Such promoters can be derived from operons encoding glycolytic enzymes such as 3- phosphoglycerate kinase (PGK), alpha-factor, acid phosphatase, or heat shock proteins, among others. The heterologous structural sequence is assembled in appropriate phase with translation initiation and termination sequences, and preferably, a leader sequence capable of directing secretion of translated protein into the periplasmic space or extracellular medium. Optionally, the heterologous sequence can encode a fusion protein including an N-terminal identification peptide imparting desired characteristics, *e.g.*, stabilization or simplified purification of expressed recombinant product.

Useful expression vectors for bacterial use are constructed by inserting a structural DNA sequence encoding a desired protein together with suitable translation initiation and termination signals in operable reading phase with a functional promoter. The vector will comprise one or more phenotypic selectable markers and an origin of replication to ensure maintenance of the vector and, when desirable, provide amplification within the host.

Suitable prokaryotic hosts for transformation include strains of *E. coli*, *B. subtilis*, *Salmonella typhimurium* and various species within the genera *Pseudomonas* and *Streptomyces*. Others may, also be employed as a matter of choice.

As a representative but non-limiting example, useful expression vectors for bacterial use can comprise a selectable marker and bacterial origin of replication

derived from commercially available plasmids comprising genetic elements of the well known cloning vector pBR322 (ATCC 37017). Such commercial vectors include, for example, pKK223-3 (available from Pharmacia Fine Chemicals, Uppsala, Sweden) and GEM 1 (available from Promega Biotec, Madison, WI, USA). These pBR322 "backbone" sections are combined with an appropriate promoter and the structural sequence to be expressed.

Following transformation of a suitable host strain and growth of the host strain to an appropriate cell density, the selected promoter, where it is inducible, is derepressed or induced by appropriate means (*e.g.*, temperature shift or chemical induction) and cells are cultured for an additional period to provide for expression of the induced gene product. Thereafter cells are typically harvested, generally by centrifugation, disrupted to release expressed protein, generally by physical or chemical means, and the resulting crude extract is retained for further purification.

Various mammalian cell culture systems can also be employed to express recombinant protein. Examples of mammalian expression systems include the COS-7 lines of monkey kidney fibroblasts, described in Gluzman, *Cell* 23:175 (1981), and other cell lines capable of expressing a compatible vector, for example, the C127, 3T3, CHO, HeLa and BHK cell lines.

Mammalian expression vectors will comprise an origin of replication, a suitable promoter and enhancer, and also any necessary ribosome binding sites, polyadenylation site, splice donor and acceptor sites, transcriptional termination sequences, and 5' flanking nontranscribed sequences. DNA sequences derived from the SV40 viral genome, for example, SV40 origin, early promoter, enhancer, splice, and polyadenylation sites may be used to provide the required nontranscribed genetic elements.

Recombinant polypeptides and proteins produced in bacterial culture is usually isolated by initial extraction from cell pellets, followed by one or more salting-out, aqueous ion exchange or size exclusion chromatography steps. Microbial cells employed in expression of proteins can be disrupted by any convenient method, including freeze-thaw cycling, sonication, mechanical disruption, or use of cell lysing agents. Protein refolding steps can be used, as necessary, in completing configuration of the mature protein. Finally, high performance liquid chromatography (HPLC) can be employed for final purification steps.

The present invention further includes isolated polypeptides, proteins and nucleic acid molecules which are substantially equivalent to those herein described. As used herein, substantially equivalent can refer both to nucleic acid and amino acid sequences, for example a mutant sequence, that varies from a reference sequence by one or more substitutions, deletions, or additions, the net effect of which does not result in an adverse functional dissimilarity between reference and subject sequences. For purposes of the present invention, sequences having equivalent biological activity, and equivalent expression characteristics are considered substantially equivalent. For purposes of determining equivalence, truncation of the mature sequence should be disregarded.

The invention further provides methods of obtaining homologs from other strains of *Streptococcus pneumoniae*, of the fragments of the *Streptococcus pneumoniae* genome of the present invention and homologs of the proteins encoded by the ORFs of the present invention. As used herein, a sequence or protein of *Streptococcus pneumoniae* is defined as a homolog of a fragment of the *Streptococcus pneumoniae* fragments or contigs or a protein encoded by one of the ORFs of the present invention, if it shares significant homology to one of the fragments of the *Streptococcus pneumoniae* genome of the present invention or a protein encoded by one of the ORFs of the present invention. Specifically, by using the sequence disclosed herein as a probe or as primers, and techniques such as PCR cloning and colony/plaque hybridization, one skilled in the art can obtain homologs.

As used herein, two nucleic acid molecules or proteins are said to "share significant homology" if the two contain regions which possess greater than 85% sequence (amino acid or nucleic acid) homology. Preferred homologs in this regard are those with more than 90% homology. Especially preferred are those with 93% or more homology. Among especially preferred homologs those with 95% or more homology are particularly preferred. Very particularly preferred among these are those with 97% and even more particularly preferred among those are homologs with 99% or more homology. The most preferred homologs among these are those with 99.9% homology or more. It will be understood that, among measures of homology, identity is particularly preferred in this regard.

Region specific primers or probes derived from the nucleotide sequence provided in SEQ ID NOS:1-391 or from a nucleotide sequence at least 95%, particularly at least 99%, especially at least 99.5% identical to a sequence of SEQ

ID NOS:1-391 can be used to prime DNA synthesis and PCR amplification, as well as to identify colonies containing cloned DNA encoding a homolog. Methods suitable to this aspect of the present invention are well known and have been described in great detail in many publications such as, for example, Innis *et al.*,  
5 *PCR Protocols*, Academic Press, San Diego, CA (1990)).

When using primers derived from SEQ ID NOS:1-391 or from a nucleotide sequence having an aforementioned identity to a sequence of SEQ ID NOS:1-391, one skilled in the art will recognize that by employing high stringency conditions (*e.g.*, annealing at 50-60°C in 6X SSPC and 50% formamide, and washing at 50-  
10 65°C in 0.5X SSPC) only sequences which are greater than 75% homologous to the primer will be amplified. By employing lower stringency conditions (*e.g.*, hybridizing at 35-37°C in 5X SSPC and 40-45% formamide, and washing at 42°C in 0.5X SSPC), sequences which are greater than 40-50% homologous to the primer will also be amplified.

When using DNA probes derived from SEQ ID NOS:1-391, or from a nucleotide sequence having an aforementioned identity to a sequence of SEQ ID NOS:1-391, for colony/plaque hybridization, one skilled in the art will recognize that by employing high stringency conditions (*e.g.*, hybridizing at 50- 65°C in 5X SSPC and 50% formamide, and washing at 50- 65°C in 0.5X SSPC), sequences  
20 having regions which are greater than 90% homologous to the probe can be obtained, and that by employing lower stringency conditions (*e.g.*, hybridizing at 35-37°C in 5X SSPC and 40-45% formamide, and washing at 42°C in 0.5X SSPC), sequences having regions which are greater than 35-45% homologous to the probe will be obtained.

25 Any organism can be used as the source for homologs of the present invention so long as the organism naturally expresses such a protein or contains genes encoding the same. The most preferred organism for isolating homologs are bacteria which are closely related to *Streptococcus pneumoniae*.

### 30 ILLUSTRATIVE USES OF COMPOSITIONS OF THE INVENTION

Each ORF provided in Tables 1 and 2 is identified with a function by homology to a known gene or polypeptide. As a result, one skilled in the art can use the polypeptides of the present invention for commercial, therapeutic and  
35 industrial purposes consistent with the type of putative identification of the

polypeptide. Such identifications permit one skilled in the art to use the *Streptococcus pneumoniae* ORFs in a manner similar to the known type of sequences for which the identification is made; for example, to ferment a particular sugar source or to produce a particular metabolite. A variety of reviews illustrative of this aspect of the invention are available, including the following reviews on the industrial use of enzymes, for example, BIOCHEMICAL ENGINEERING AND BIOTECHNOLOGY HANDBOOK, 2nd Ed., MacMillan Publications, Ltd. NY (1991) and BIOCATALYSTS IN ORGANIC SYNTHESSES, Tramper *et al.*, Eds., Elsevier Science Publishers, Amsterdam, The Netherlands (1985). A variety of exemplary uses that illustrate this and similar aspects of the present invention are discussed below.

### 1. Biosynthetic Enzymes

Open reading frames encoding proteins involved in mediating the catalytic reactions involved in intermediary and macromolecular metabolism, the biosynthesis of small molecules, cellular processes and other functions includes enzymes involved in the degradation of the intermediary products of metabolism, enzymes involved in central intermediary metabolism, enzymes involved in respiration, both aerobic and anaerobic, enzymes involved in fermentation, enzymes involved in ATP proton motor force conversion, enzymes involved in broad regulatory function, enzymes involved in amino acid synthesis, enzymes involved in nucleotide synthesis, enzymes involved in cofactor and vitamin synthesis, can be used for industrial biosynthesis.

The various metabolic pathways present in *Streptococcus pneumoniae* can be identified based on absolute nutritional requirements as well as by examining the various enzymes identified in Table 1-3 and SEQ ID NOS:1-391.

Of particular interest are polypeptides involved in the degradation of intermediary metabolites as well as non-macromolecular metabolism. Such enzymes include amylases, glucose oxidases, and catalase.

Proteolytic enzymes are another class of commercially important enzymes. Proteolytic enzymes find use in a number of industrial processes including the processing of flax and other vegetable fibers, in the extraction, clarification and depectinization of fruit juices, in the extraction of vegetables' oil and in the maceration of fruits and vegetables to give unicellular fruits. A detailed review of the proteolytic enzymes used in the food industry is provided in Rombouts *et al.*,

*Symbiosis* 21:79 (1986) and Voragen *et al.* in *Biocatalysts In Agricultural Biotechnology*, Whitaker *et al.*, Eds., *American Chemical Society Symposium Series* 389:93 (1989).

The metabolism of sugars is an important aspect of the primary metabolism of *Streptococcus pneumoniae*. Enzymes involved in the degradation of sugars, such as, particularly, glucose, galactose, fructose and xylose, can be used in industrial fermentation. Some of the important sugar transforming enzymes, from a commercial viewpoint, include sugar isomerases such as glucose isomerase. Other metabolic enzymes have found commercial use such as glucose oxidases which produces ketogulonic acid (KGA). KGA is an intermediate in the commercial production of ascorbic acid using the Reichstein's procedure, as described in Krueger *et al.*, *Biotechnology* 6(A), Rhine *et al.*, Eds., Verlag Press, Weinheim, Germany (1984).

Glucose oxidase (GOD) is commercially available and has been used in purified form as well as in an immobilized form for the deoxygenation of beer. See, for instance, Hartmeir *et al.*, *Biotechnology Letters* 1:21 (1979). The most important application of GOD is the industrial scale fermentation of gluconic acid. Market for gluconic acids which are used in the detergent, textile, leather, photographic, pharmaceutical, food, feed and concrete industry, as described, for example, in Bigelis *et al.*, beginning on page 357 in *GENE MANIPULATIONS AND FUNGI*; Benett *et al.*, Eds., Academic Press, New York (1985). In addition to industrial applications, GOD has found applications in medicine for quantitative determination of glucose in body fluids recently in biotechnology for analyzing syrups from starch and cellulose hydrosylates. This application is described in Owusu *et al.*, *Biochem. et Biophysica. Acta.* 872:83 (1986), for instance.

The main sweetener used in the world today is sugar which comes from sugar beets and sugar cane. In the field of industrial enzymes, the glucose isomerase process shows the largest expansion in the market today. Initially, soluble enzymes were used and later immobilized enzymes were developed (Krueger *et al.*, *Biotechnology, The Textbook of Industrial Microbiology*, Sinauer Associated Incorporated, Sunderland, Massachusetts (1990)). Today, the use of glucose- produced high fructose syrups is by far the largest industrial business using immobilized enzymes. A review of the industrial use of these enzymes is provided by Jorgensen, *Starch* 40:307 (1988).

Proteinases, such as alkaline serine proteinases, are used as detergent additives and thus represent one of the largest volumes of microbial enzymes used in the industrial sector. Because of their industrial importance, there is a large body of published and unpublished information regarding the use of these enzymes in industrial processes. (See Faultman *et al.*, *Acid Proteases Structure Function and Biology*, Tang, J., ed., Plenum Press, New York (1977) and Godfrey *et al.*, *Industrial Enzymes*, MacMillan Publishers, Surrey, UK (1983) and Hepner *et al.*, *Report Industrial Enzymes by 1990*, Hel Hepner & Associates, London (1986)).

Another class of commercially usable proteins of the present invention are the microbial lipases, described by, for instance, Macrae *et al.*, *Philosophical Transactions of the Chiral Society of London* 310:227 (1985) and Poserke, *Journal of the American Oil Chemist Society* 61:1758 (1984). A major use of lipases is in the fat and oil industry for the production of neutral glycerides using lipase catalyzed inter-esterification of readily available triglycerides. Application of lipases include the use as a detergent additive to facilitate the removal of fats from fabrics in the course of the washing procedures.

The use of enzymes, and in particular microbial enzymes, as catalyst for key steps in the synthesis of complex organic molecules is gaining popularity at a great rate. One area of great interest is the preparation of chiral intermediates. Preparation of chiral intermediates is of interest to a wide range of synthetic chemists particularly those scientists involved with the preparation of new pharmaceuticals, agrochemicals, fragrances and flavors. (See Davies *et al.*, *Recent Advances in the Generation of Chiral Intermediates Using Enzymes*, CRC Press, Boca Raton, Florida (1990)). The following reactions catalyzed by enzymes are of interest to organic chemists: hydrolysis of carboxylic acid esters, phosphate esters, amides and nitriles, esterification reactions, trans-esterification reactions, synthesis of amides, reduction of alkanones and oxoalkanates, oxidation of alcohols to carbonyl compounds, oxidation of sulfides to sulfoxides, and carbon bond forming reactions such as the aldol reaction.

When considering the use of an enzyme encoded by one of the ORFs of the present invention for biotransformation and organic synthesis it is sometimes necessary to consider the respective advantages and disadvantages of using a microorganism as opposed to an isolated enzyme. Pros and cons of using a whole cell system on the one hand or an isolated partially purified enzyme on the other

hand, has been described in detail by Bud *et al.*, Chemistry in Britain (1987), p. 127.

Amino transferases, enzymes involved in the biosynthesis and metabolism of amino acids, are useful in the catalytic production of amino acids. The advantages of using microbial based enzyme systems is that the amino transferase enzymes catalyze the stereo- selective synthesis of only L-amino acids and generally possess uniformly high catalytic rates. A description of the use of amino transferases for amino acid production is provided by Roselle-David, *Methods of Enzymology* 136:479 (1987).

Another category of useful proteins encoded by the ORFs of the present invention include enzymes involved in nucleic acid synthesis, repair, and recombination.

## 2. Generation of Antibodies

As described here, the proteins of the present invention, as well as homologs thereof, can be used in a variety of procedures and methods known in the art which are currently applied to other proteins. The proteins of the present invention can further be used to generate an antibody which selectively binds the protein. Such antibodies can be either monoclonal or polyclonal antibodies, as well as fragments of these antibodies, and humanized forms.

The invention further provides antibodies which selectively bind to one of the proteins of the present invention and hybridomas which produce these antibodies. A hybridoma is an immortalized cell line which is capable of secreting a specific monoclonal antibody.

In general, techniques for preparing polyclonal and monoclonal antibodies as well as hybridomas capable of producing the desired antibody are well known in the art (Campbell, A. M., *Monoclonal Antibody Technology: Laboratory Techniques In Biochemistry And Molecular Biology*, Elsevier Science Publishers, Amsterdam, The Netherlands (1984); St. Groth *et al.*, *J. Immunol. Methods* 35: 1-21 (1980), Kohler and Milstein, *Nature* 256:495-497 (1975)), the trioma technique, the human B-cell hybridoma technique (Kozbor *et al.*, *Immunology Today* 4:72 (1983), pgs. 77-96 of Cole *et al.*, in *Monoclonal Antibodies And Cancer Therapy*, Alan R. Liss, Inc. (1985)). Any animal (mouse, rabbit, etc.) which is known to produce antibodies can be immunized with the pseudogene polypeptide. Methods for immunization are well known in the art. Such methods



include subcutaneous or interperitoneal injection of the polypeptide. One skilled in the art will recognize that the amount of the protein encoded by the ORF of the present invention used for immunization will vary based on the animal which is immunized, the antigenicity of the peptide and the site of injection.

5       The protein which is used as an immunogen may be modified or administered in an adjuvant in order to increase the protein's antigenicity. Methods of increasing the antigenicity of a protein are well known in the art and include, but are not limited to coupling the antigen with a heterologous protein (such as globulin or galactosidase) or through the inclusion of an adjuvant during immunization.

10       For monoclonal antibodies, spleen cells from the immunized animals are removed, fused with myeloma cells, such as SP2/0-Ag14 myeloma cells, and allowed to become monoclonal antibody producing hybridoma cells.

Any one of a number of methods well known in the art can be used to identify the hybridoma cell which produces an antibody with the desired characteristics. These include screening the hybridomas with an ELISA assay, western blot analysis, or radioimmunoassay (Lutz *et al.*, *Exp. Cell Res.* 175:109-124 (1988)).

Hybridomas secreting the desired antibodies are cloned and the class and subclass is determined using procedures known in the art (Campbell, A. M., *Monoclonal Antibody Technology: Laboratory Techniques in Biochemistry and Molecular Biology*, Elsevier Science Publishers, Amsterdam, The Netherlands (1984)).

Techniques described for the production of single chain antibodies (U. S. Patent 4,946,778) can be adapted to produce single chain antibodies to proteins of the present invention.

For polyclonal antibodies, antibody containing antisera is isolated from the immunized animal and is screened for the presence of antibodies with the desired specificity using one of the above-described procedures.

The present invention further provides the above-described antibodies in detectably labelled form. Antibodies can be detectably labelled through the use of radioisotopes, affinity labels (such as biotin, avidin, *etc.*), enzymatic labels (such as horseradish peroxidase, alkaline phosphatase, *etc.*) fluorescent labels (such as FITC or rhodamine, *etc.*), paramagnetic atoms, *etc.* Procedures for accomplishing such labeling are well-known in the art, for example see Sternberger *et al.*, *J. Histochem. Cytochem.* 18:315 (1970); Bayer, E. A. *et al.*, *Meth. Enzym.* 62:308

(1979); Engval, E. *et al.*, *Immunol.* 109:129 (1972); Goding, J. W., *J. Immunol. Meth.* 13:215 (1976)).

The labeled antibodies of the present invention can be used for *in vitro*, *in vivo*, and in situ assays to identify cells or tissues in which a fragment of the  
5 *Streptococcus pneumoniae* genome is expressed.

The present invention further provides the above-described antibodies immobilized on a solid support. Examples of such solid supports include plastics such as polycarbonate, complex carbohydrates such as agarose and sepharose, acrylic resins and such as polyacrylamide and latex beads. Techniques for  
10 coupling antibodies to such solid supports are well known in the art (Weir, D. M. *et al.*, "Handbook of Experimental Immunology" 4th Ed., Blackwell Scientific Publications, Oxford, England, Chapter 10 (1986); Jacoby, W. D. *et al.*, *Meth. Enzym.* 34 Academic Press, N. Y. (1974)). The immobilized antibodies of the present invention can be used for *in vitro*, *in vivo*, and in situ assays as well as for  
15 immunoaffinity purification of the proteins of the present invention.

### 3. Diagnostic Assays and Kits

The present invention further provides methods to identify the expression of one of the ORFs of the present invention, or homolog thereof, in a test sample,  
20 using one of the DFs or antibodies of the present invention.

In detail, such methods comprise incubating a test sample with one or more of the antibodies or one or more of the DFs of the present invention and assaying for binding of the DFs or antibodies to components within the test sample.

Conditions for incubating a DF or antibody with a test sample vary.  
25 Incubation conditions depend on the format employed in the assay, the detection methods employed, and the type and nature of the DF or antibody used in the assay. One skilled in the art will recognize that any one of the commonly available hybridization, amplification or immunological assay formats can readily be adapted to employ the DFs or antibodies of the present invention. Examples of such assays  
30 can be found in Chard, T., *An Introduction to Radioimmunoassay and Related Techniques*, Elsevier Science Publishers, Amsterdam, The Netherlands (1986); Bullock, G. R. *et al.*, *Techniques in Immunocytochemistry*, Academic Press, Orlando, FL Vol. 1 (1982), Vol. 2 (1983), Vol. 3 (1985); Tijssen, P., *Practice and Theory of Enzyme Immunoassays: Laboratory Techniques in Biochemistry and*

*Molecular Biology*, Elsevier Science Publishers, Amsterdam, The Netherlands (1985).

5 The test samples of the present invention include cells, protein or membrane extracts of cells, or biological fluids such as sputum, blood, serum, plasma, or urine. The test sample used in the above-described method will vary based on the assay format, nature of the detection method and the tissues, cells or extracts used as the sample to be assayed. Methods for preparing protein extracts or membrane extracts of cells are well known in the art and can be readily be adapted in order to obtain a sample which is compatible with the system utilized.

10 In another embodiment of the present invention, kits are provided which contain the necessary reagents to carry out the assays of the present invention.

Specifically, the invention provides a compartmentalized kit to receive, in close confinement, one or more containers which comprises: (a) a first container comprising one of the DFs or antibodies of the present invention; and (b) one or more other containers comprising one or more of the following: wash reagents, reagents capable of detecting presence of a bound DF or antibody.

20 In detail, a compartmentalized kit includes any kit in which reagents are contained in separate containers. Such containers include small glass containers, plastic containers or strips of plastic or paper. Such containers allows one to efficiently transfer reagents from one compartment to another compartment such that the samples and reagents are not cross-contaminated, and the agents or solutions of each container can be added in a quantitative fashion from one compartment to another. Such containers will include a container which will accept the test sample, a container which contains the antibodies used in the assay, 25 containers which contain wash reagents (such as phosphate buffered saline, Tris-buffers, *etc.*), and containers which contain the reagents used to detect the bound antibody or DF.

30 Types of detection reagents include labelled nucleic acid probes, labelled secondary antibodies, or in the alternative, if the primary antibody is labelled, the enzymatic, or antibody binding reagents which are capable of reacting with the labelled antibody. One skilled in the art will readily recognize that the disclosed DFs and antibodies of the present invention can be readily incorporated into one of the established kit formats which are well known in the art.

#### 35 4. Screening Assay for Binding Agents

Using the isolated proteins of the present invention, the present invention further provides methods of obtaining and identifying agents which bind to a protein encoded by one of the ORFs of the present invention or to one of the fragments and the *Streptococcus pneumoniae* fragment and contigs herein  
5 described.

In general, such methods comprise steps of:

- (a) contacting an agent with an isolated protein encoded by one of the ORFs of the present invention, or an isolated fragment of the *Streptococcus pneumoniae* genome; and
- 10 (b) determining whether the agent binds to said protein or said fragment.

The agents screened in the above assay can be, but are not limited to, peptides, carbohydrates, vitamin derivatives, or other pharmaceutical agents. The agents can be selected and screened at random or rationally selected or designed using protein modeling techniques.

- 15 For random screening, agents such as peptides, carbohydrates, pharmaceutical agents and the like are selected at random and are assayed for their ability to bind to the protein encoded by the ORF of the present invention.

Alternatively, agents may be rationally selected or designed. As used herein, an agent is said to be "rationally selected or designed" when the agent is  
20 chosen based on the configuration of the particular protein. For example, one skilled in the art can readily adapt currently available procedures to generate peptides, pharmaceutical agents and the like capable of binding to a specific peptide sequence in order to generate rationally designed antipeptide peptides, for example see Hurby *et al.*, "Application of Synthetic Peptides: Antisense Peptides," in  
25 *Synthetic Peptides, A User's Guide*, W. H. Freeman, NY (1992), pp. 289-307, and Kaspczak *et al.*, *Biochemistry* 28:9230-8 (1989), or pharmaceutical agents, or the like.

In addition to the foregoing, one class of agents of the present invention, as broadly described, can be used to control gene expression through binding to one  
30 of the ORFs or EMFs of the present invention. As described above, such agents can be randomly screened or rationally designed/selected. Targeting the ORF or EMF allows a skilled artisan to design sequence specific or element specific agents, modulating the expression of either a single ORF or multiple ORFs which rely on the same EMF for expression control.

One class of DNA binding agents are agents which contain base residues which hybridize or form a triple helix by binding to DNA or RNA. Such agents can be based on the classic phosphodiester, ribonucleic acid backbone, or can be a variety of sulfhydryl or polymeric derivatives which have base attachment capacity.

5 Agents suitable for use in these methods usually contain 20 to 40 bases and are designed to be complementary to a region of the gene involved in transcription (triple helix - see Lee *et al.*, *Nucl. Acids Res.* 6:3073 (1979); Cooney *et al.*, *Science* 241:456 (1988); and Dervan *et al.*, *Science* 251:1360 (1991)) or to the mRNA itself (antisense - Okano, *J. Neurochem.* 56:560 (1991);  
10 *Oligodeoxynucleotides as Antisense Inhibitors of Gene Expression*, CRC Press, Boca Raton, FL (1988)). Triple helix- formation optimally results in a shut-off of RNA transcription from DNA, while antisense RNA hybridization blocks translation of an mRNA molecule into polypeptide. Both techniques have been demonstrated to be effective in model systems. Information contained in the  
15 sequences of the present invention can be used to design antisense and triple helix-forming oligonucleotides, and other DNA binding agents.

### 5. Pharmaceutical Compositions and Vaccines

The present invention further provides pharmaceutical agents which can be  
20 used to modulate the growth or pathogenicity of *Streptococcus pneumoniae*, or another related organism, *in vivo* or *in vitro*. As used herein, a "pharmaceutical agent" is defined as a composition of matter which can be formulated using known techniques to provide a pharmaceutical compositions. As used herein, the "pharmaceutical agents of the present invention" refers the pharmaceutical agents  
25 which are derived from the proteins encoded by the ORFs of the present invention or are agents which are identified using the herein described assays.

As used herein, a pharmaceutical agent is said to "modulate the growth pathogenicity of *Streptococcus pneumoniae* or a related organism, *in vivo* or *in vitro*," when the agent reduces the rate of growth, rate of division, or viability of  
30 the organism in question. The pharmaceutical agents of the present invention can modulate the growth or pathogenicity of an organism in many fashions, although an understanding of the underlying mechanism of action is not needed to practice the use of the pharmaceutical agents of the present invention. Some agents will modulate the growth by binding to an important protein thus blocking the biological  
35 activity of the protein, while other agents may bind to a component of the outer

surface of the organism blocking attachment or rendering the organism more prone to act the bodies nature immune system. Alternatively, the agent may comprise a protein encoded by one of the ORFs of the present invention and serve as a vaccine. The development and use of a vaccine based on outer membrane components are well known in the art.

As used herein, a "related organism" is a broad term which refers to any organism whose growth can be modulated by one of the pharmaceutical agents of the present invention. In general, such an organism will contain a homolog of the protein which is the target of the pharmaceutical agent or the protein used as a vaccine. As such, related organisms do not need to be bacterial but may be fungal or viral pathogens.

The pharmaceutical agents and compositions of the present invention may be administered in a convenient manner, such as by the oral, topical, intravenous, intraperitoneal, intramuscular, subcutaneous, intranasal or intradermal routes. The pharmaceutical compositions are administered in an amount which is effective for treating and/or prophylaxis of the specific indication. In general, they are administered in an amount of at least about 1 mg/kg body weight and in most cases they will be administered in an amount not in excess of about 1 g/kg body weight per day. In most cases, the dosage is from about 0.1 mg/kg to about 10 g/kg body weight daily, taking into account the routes of administration, symptoms, *etc.*

The agents of the present invention can be used in native form or can be modified to form a chemical derivative. As used herein, a molecule is said to be a "chemical derivative" of another molecule when it contains additional chemical moieties not normally a part of the molecule. Such moieties may improve the molecule's solubility, absorption, biological half life, *etc.* The moieties may alternatively decrease the toxicity of the molecule, eliminate or attenuate any undesirable side effect of the molecule, *etc.* Moieties capable of mediating such effects are disclosed in, among other sources, REMINGTON'S PHARMACEUTICAL SCIENCES (1980) cited elsewhere herein.

For example, such moieties may change an immunological character of the functional derivative, such as affinity for a given antibody. Such changes in immunomodulation activity are measured by the appropriate assay, such as a competitive type immunoassay. Modifications of such protein properties as redox or thermal stability, biological half-life, hydrophobicity, susceptibility to proteolytic degradation or the tendency to aggregate with carriers or into multimers also may

be effected in this way and can be assayed by methods well known to the skilled artisan.

The therapeutic effects of the agents of the present invention may be obtained by providing the agent to a patient by any suitable means (*e.g.*, inhalation, intravenously, intramuscularly, subcutaneously, enterally, or parenterally). It is preferred to administer the agent of the present invention so as to achieve an effective concentration within the blood or tissue in which the growth of the organism is to be controlled. To achieve an effective blood concentration, the preferred method is to administer the agent by injection. The administration may be by continuous infusion, or by single or multiple injections.

In providing a patient with one of the agents of the present invention, the dosage of the administered agent will vary depending upon such factors as the patient's age, weight, height, sex, general medical condition, previous medical history, *etc.* In general, it is desirable to provide the recipient with a dosage of agent which is in the range of from about 1 pg/kg to 10 mg/kg (body weight of patient), although a lower or higher dosage may be administered. The therapeutically effective dose can be lowered by using combinations of the agents of the present invention or another agent.

As used herein, two or more compounds or agents are said to be administered "in combination" with each other when either (1) the physiological effects of each compound, or (2) the serum concentrations of each compound can be measured at the same time. The composition of the present invention can be administered concurrently with, prior to, or following the administration of the other agent.

The agents of the present invention are intended to be provided to recipient subjects in an amount sufficient to decrease the rate of growth (as defined above) of the target organism.

The administration of the agent(s) of the invention may be for either a "prophylactic" or "therapeutic" purpose. When provided prophylactically, the agent(s) are provided in advance of any symptoms indicative of the organisms growth. The prophylactic administration of the agent(s) serves to prevent, attenuate, or decrease the rate of onset of any subsequent infection. When provided therapeutically, the agent(s) are provided at (or shortly after) the onset of an indication of infection. The therapeutic administration of the compound(s)

serves to attenuate the pathological symptoms of the infection and to increase the rate of recovery.

The agents of the present invention are administered to a subject, such as a mammal, or a patient, in a pharmaceutically acceptable form and in a therapeutically effective concentration. A composition is said to be "pharmacologically acceptable" if its administration can be tolerated by a recipient patient. Such an agent is said to be administered in a "therapeutically effective amount" if the amount administered is physiologically significant. An agent is physiologically significant if its presence results in a detectable change in the physiology of a recipient patient.

The agents of the present invention can be formulated according to known methods to prepare pharmaceutically useful compositions, whereby these materials, or their functional derivatives, are combined in a mixture with a pharmaceutically acceptable carrier vehicle. Suitable vehicles and their formulation, inclusive of other human proteins, *e.g.*, human serum albumin, are described, for example, in REMINGTON'S PHARMACEUTICAL SCIENCES, 16<sup>th</sup> Ed., Osol, A., Ed., Mack Publishing, Easton PA (1980). In order to form a pharmaceutically acceptable composition suitable for effective administration, such compositions will contain an effective amount of one or more of the agents of the present invention, together with a suitable amount of carrier vehicle.

Additional pharmaceutical methods may be employed to control the duration of action. Control release preparations may be achieved through the use of polymers to complex or absorb one or more of the agents of the present invention. The controlled delivery may be effectuated by a variety of well known techniques, including formulation with macromolecules such as, for example, polyesters, polyamino acids, polyvinyl, pyrrolidone, ethylenevinylacetate, methylcellulose, carboxymethylcellulose, or protamine, sulfate, adjusting the concentration of the macromolecules and the agent in the formulation, and by appropriate use of methods of incorporation, which can be manipulated to effectuate a desired time course of release. Another possible method to control the duration of action by controlled release preparations is to incorporate agents of the present invention into particles of a polymeric material such as polyesters, polyamino acids, hydrogels, poly(lactic acid) or ethylene vinylacetate copolymers. Alternatively, instead of incorporating these agents into polymeric particles, it is possible to entrap these materials in microcapsules prepared, for example, by coacervation techniques or by interfacial polymerization with, for example, hydroxymethylcellulose or gelatine-



microcapsules and poly(methylmethacrylate) microcapsules, respectively, or in colloidal drug delivery systems, for example, liposomes, albumin microspheres, microemulsions, nanoparticles, and nanocapsules or in macroemulsions. Such techniques are disclosed in REMINGTON'S PHARMACEUTICAL SCIENCES (1980).

The invention further provides a pharmaceutical pack or kit comprising one or more containers filled with one or more of the ingredients of the pharmaceutical compositions of the invention. Associated with such container(s) can be a notice in the form prescribed by a governmental agency regulating the manufacture, use or sale of pharmaceuticals or biological products, which notice reflects approval by the agency of manufacture, use or sale for human administration.

In addition, the agents of the present invention may be employed in conjunction with other therapeutic compounds.

## 6. Shot-Gun Approach to Megabase DNA Sequencing

The present invention further demonstrates that a large sequence can be sequenced using a random shotgun approach. This procedure, described in detail in the examples that follow, has eliminated the up front cost of isolating and ordering overlapping or contiguous subclones prior to the start of the sequencing protocols.

Certain aspects of the present invention are described in greater detail in the examples that follow. The examples are provided by way of illustration. Other aspects and embodiments of the present invention are contemplated by the inventors, as will be clear to those of skill in the art from reading the present disclosure.

## ILLUSTRATIVE EXAMPLES

### LIBRARIES AND SEQUENCING

#### 1. Shotgun Sequencing Probability Analysis

The overall strategy for a shotgun approach to whole genome sequencing follows from the Lander and Waterman (Landerman and Waterman, *Genomics* 2:231 (1988)) application of the equation for the Poisson distribution. According to this treatment, the probability,  $P$ , that any given base in a sequence of size  $L$ , in nucleotides, is not sequenced after a certain amount,  $n$ , in nucleotides, of random

sequence has been determined can be calculated by the equation  $P = e^{-m}$ , where  $m$  is  $L/n$ , the fold coverage. For instance, for a genome of 2.8 Mb,  $m=1$  when 2.8 Mb of sequence has been randomly generated (1X coverage). At that point,  $P = e^{-1} = 0.37$ . The probability that any given base has not been sequenced is the same as the probability that any region of the whole sequence  $L$  has not been determined and, therefore, is equivalent to the fraction of the whole sequence that has yet to be determined. Thus, at one-fold coverage, approximately 37% of a polynucleotide of size  $L$ , in nucleotides has not been sequenced. When 14 Mb of sequence has been generated, coverage is 5X for a 2.8 Mb and the unsequenced fraction drops to .0067 or 0.67%. 5X coverage of a 2.8 Mb sequence can be attained by sequencing approximately 17,000 random clones from both insert ends with an average sequence read length of 410 bp.

Similarly, the total gap length,  $G$ , is determined by the equation  $G = Le^{-m}$ , and the average gap size,  $g$ , follows the equation,  $g = L/n$ . Thus, 5X coverage leaves about 240 gaps averaging about 82 bp in size in a sequence of a polynucleotide 2.8 Mb long.

The treatment above is essentially that of Lander and Waterman, *Genomics* 2: 231 (1988).

## 2. Random Library Construction

In order to approximate the random model described above during actual sequencing, a nearly ideal library of cloned genomic fragments is required. The following library construction procedure was developed to achieve this end.

*Streptococcus pneumoniae* DNA is prepared by phenol extraction. A mixture containing 200  $\mu$ g DNA in 1.0 ml of 300 mM sodium acetate, 10 mM Tris-HCl, 1 mM Na-EDTA, 50% glycerol is processed through a nebulizer (IPI Medical Products) with a stream of nitrogen adjusted to 35 Kpa for 2 minutes. The sonicated DNA is ethanol precipitated and redissolved in 500  $\mu$ l TE buffer.

To create blunt-ends, a 100  $\mu$ l aliquot of the resuspended DNA is digested with 5 units of BAL31 nuclease (New England BioLabs) for 10 min at 30°C in 200  $\mu$ l BAL31 buffer. The digested DNA is phenol-extracted, ethanol-precipitated, redissolved in 100  $\mu$ l TE buffer, and then size-fractionated by electrophoresis through a 1.0% low melting temperature agarose gel. The section containing DNA fragments 1.6-2.0 kb in size is excised from the gel, and the LGT agarose is melted and the resulting solution is extracted with phenol to separate the agarose from the

DNA. DNA is ethanol precipitated and redissolved in 20  $\mu$ l of TE buffer for ligation to vector.

A two-step ligation procedure is used to produce a plasmid library with 97% inserts, of which >99% were single inserts. The first ligation mixture (50  $\mu$ l) contains 2  $\mu$ g of DNA fragments, 2  $\mu$ g pUC18 DNA (Pharmacia) cut with SmaI and dephosphorylated with bacterial alkaline phosphatase, and 10 units of T4 ligase (GIBCO/BRL) and is incubated at 14°C for 4 hr. The ligation mixture then is phenol extracted and ethanol precipitated, and the precipitated DNA is dissolved in 20  $\mu$ l TE buffer and electrophoresed on a 1.0% low melting agarose gel. Discrete bands in a ladder are visualized by ethidium bromide-staining and UV illumination and identified by size as insert (I), vector (v), v+I, v+2i, v+3i, etc. The portion of the gel containing v+I DNA is excised and the v+I DNA is recovered and resuspended into 20  $\mu$ l TE. The v+I DNA then is blunt-ended by T4 polymerase treatment for 5 min. at 37°C in a reaction mixture (50  $\mu$ l) containing the v+I linears, 500  $\mu$ M each of the 4 dNTPs, and 9 units of T4 polymerase (New England BioLabs), under recommended buffer conditions. After phenol extraction and ethanol precipitation the repaired v+I linears are dissolved in 20  $\mu$ l TE. The final ligation to produce circles is carried out in a 50  $\mu$ l reaction containing 5  $\mu$ l of v+I linears and 5 units of T4 ligase at 14°C overnight. After 10 min. at 70°C the following day, the reaction mixture is stored at -20°C.

This two-stage procedure results in a molecularly random collection of single-insert plasmid recombinants with minimal contamination from double-insert chimeras (<1%) or free vector (<3%).

Since deviation from randomness can arise from propagation the DNA in the host, *E. coli* host cells deficient in all recombination and restriction functions (A. Greener, *Strategies* 3 (1):5 (1990)) are used to prevent rearrangements, deletions, and loss of clones by restriction. Furthermore, transformed cells are plated directly on antibiotic diffusion plates to avoid the usual broth recovery phase which allows multiplication and selection of the most rapidly growing cells.

Plating is carried out as follows. A 100  $\mu$ l aliquot of Epicurian Coli SURE II Supercompetent Cells (Stratagene 200152) is thawed on ice and transferred to a chilled Falcon 2059 tube on ice. A 1.7  $\mu$ l aliquot of 1.42 M beta-mercaptoethanol is added to the aliquot of cells to a final concentration of 25 mM. Cells are incubated on ice for 10 min. A 1  $\mu$ l aliquot of the final ligation is added to the cells and incubated on ice for 30 min. The cells are heat pulsed for 30 sec. at 42°C and

placed back on ice for 2 min. The outgrowth period in liquid culture is eliminated from this protocol in order to minimize the preferential growth of any given transformed cell. Instead the transformation mixture is plated directly on a nutrient rich SOB plate containing a 5 ml bottom layer of SOB agar (5% SOB agar: 20 g  
5 tryptone, 5 g yeast extract, 0.5 g NaCl, 1.5% Difco Agar per liter of media). The 5 ml bottom layer is supplemented with 0.4 ml of 50 mg/ml ampicillin per 100 ml SOB agar. The 15 ml top layer of SOB agar is supplemented with 1 ml X-Gal (2%), 1 ml MgCl<sub>2</sub> (1 M), and 1 ml MgSO<sub>4</sub> /100 ml SOB agar. The 15 ml top layer is poured just prior to plating. Our titer is approximately 100 colonies/10  $\mu$ l aliquot  
10 of transformation.<sup>2</sup><sub>4</sub>

All colonies are picked for template preparation regardless of size. Thus, only clones lost due to "poison" DNA or deleterious gene products are deleted from the library, resulting in a slight increase in gap number over that expected.

### 15 3. Random DNA Sequencing

High quality double stranded DNA plasmid templates are prepared using a "boiling bead" method developed in collaboration with Advanced Genetic Technology Corp. (Gaithersburg, MD) (Adams *et al.*, *Science* 252:1651 (1991); Adams *et al.*, *Nature* 355:632 (1992)). Plasmid preparation is performed in a 96-  
20 well format for all stages of DNA preparation from bacterial growth through final DNA purification. Template concentration is determined using Hoechst Dye and a Millipore Cytofluor. DNA concentrations are not adjusted, but low-yielding templates are identified where possible and not sequenced.

Templates are also prepared from two *Streptococcus pneumoniae* lambda  
25 genomic libraries. An amplified library is constructed in the vector Lambda GEM-12 (Promega) and an unamplified library is constructed in Lambda DASH II (Stratagene). In particular, for the unamplified lambda library, *Streptococcus pneumoniae* DNA (> 100 kb) is partially digested in a reaction mixture (200  $\mu$ l) containing 50  $\mu$ g DNA, 1X Sau3AI buffer, 20 units Sau3AI for 6 min. at 23°C.  
30 The digested DNA was phenol-extracted and electrophoresed on a 0.5% low melting agarose gel at 2V/cm for 7 hours. Fragments from 15 to 25 kb are excised and recovered in a final volume of 6  $\mu$ l. One  $\mu$ l of fragments is used with 1  $\mu$ l of DASHII vector (Stratagene) in the recommended ligation reaction. One  $\mu$ l of the ligation mixture is used per packaging reaction following the recommended  
35 protocol with the Gigapack II XL Packaging Extract (Stratagene, #227711). Phage

are plated directly without amplification from the packaging mixture (after dilution with 500  $\mu$ l of recommended SM buffer and chloroform treatment). Yield is about  $2.5 \times 10^3$  pfu/ $\mu$ l. The amplified library is prepared essentially as above except the lambda GEM-12 vector is used. After packaging, about  $3.5 \times 10^4$  pfu are plated on the restrictive NM539 host. The lysate is harvested in 2 ml of SM buffer and stored frozen in 7% dimethylsulfoxide. The phage titer is approximately  $1 \times 10^9$  pfu/ml.

Liquid lysates (100  $\mu$ l) are prepared from randomly selected plaques (from the unamplified library) and template is prepared by long-range PCR using T7 and T3 vector-specific primers.

Sequencing reactions are carried out on plasmid and/or PCR templates using the AB Catalyst LabStation with Applied Biosystems PRISM Ready Reaction Dye Primer Cycle Sequencing Kits for the M13 forward (M13-21) and the M13 reverse (M13RP1) primers (Adams *et al.*, *Nature* 368:474 (1994)). Dye terminator sequencing reactions are carried out on the lambda templates on a Perkin-Elmer 9600 Thermocycler using the Applied Biosystems Ready Reaction Dye Terminator Cycle Sequencing kits. T7 and SP6 primers are used to sequence the ends of the inserts from the Lambda GEM-12 library and T7 and T3 primers are used to sequence the ends of the inserts from the Lambda DASH II library. Sequencing reactions are performed by eight individuals using an average of fourteen AB 373 DNA Sequencers per day. All sequencing reactions are analyzed using the Stretch modification of the AB 373, primarily using a 34 cm well-to-read distance. The overall sequencing success rate very approximately is about 85% for M13-21 and M13RP1 sequences and 65% for dye-terminator reactions. The average usable read length is 485 bp for M13-21 sequences, 445bp for M13RP1 sequences, and 375 bp for dye-terminator reactions.

Richards *et al.*, Chapter 28 in AUTOMATED DNA SEQUENCING AND ANALYSIS, M. D. Adams, C. Fields, J. C. Venter, Eds., Academic Press, London, (1994) described the value of using sequence from both ends of sequencing templates to facilitate ordering of contigs in shotgun assembly projects of lambda and cosmid clones. We balance the desirability of both-end sequencing (including the reduced cost of lower total number of templates) against shorter read-lengths for sequencing reactions performed with the M13RP1 (reverse) primer compared to the M13-21 (forward) primer. Approximately one-half of the templates are sequenced from both ends. Random reverse sequencing reactions are

done based on successful forward sequencing reactions. Some M13RP1 sequences are obtained in a semi-directed fashion: M13-21: sequences pointing outward at the ends of contigs are chosen for M13RP1 sequencing in an effort to specifically order contigs.

5

#### 4. Protocol for Automated Cycle Sequencing

The sequencing is carried out using ABI Catalyst robots and AB 373 Automated DNA Sequencers. The Catalyst robot is a publicly available sophisticated pipetting and temperature control robot which has been developed specifically for DNA sequencing reactions. The Catalyst combines pre-aliquoted templates and reaction mixes consisting of deoxy- and dideoxynucleotides, the thermostable Taq DNA polymerase, fluorescently-labelled sequencing primers, and reaction buffer. Reaction mixes and templates are combined in the wells of an aluminum 96-well thermocycling plate. Thirty consecutive cycles of linear amplification (*i.e.*, one primer synthesis) steps are performed including denaturation, annealing of primer and template, and extension; *i.e.*, DNA synthesis. A heated lid with rubber gaskets on the thermocycling plate prevents evaporation without the need for an oil overlay.

Two sequencing protocols are used: one for dye-labelled primers and a second for dye-labelled dideoxy chain terminators. The shotgun sequencing involves use of four dye-labelled sequencing primers, one for each of the four terminator nucleotide. Each dye-primer is labelled with a different fluorescent dye, permitting the four individual reactions to be combined into one lane of the 373 DNA Sequencer for electrophoresis, detection, and base-calling. ABI currently supplies pre-mixed reaction mixes in bulk packages containing all the necessary non-template reagents for sequencing. Sequencing can be done with both plasmid and PCR-generated templates with both dye-primers and dye-terminators with approximately equal fidelity, although plasmid templates generally give longer usable sequences.

Thirty-two reactions are loaded per AB373 Sequencer each day, for a total of 960 samples. Electrophoresis is run overnight following the manufacturer's protocols, and the data is collected for twelve hours. Following electrophoresis and fluorescence detection, the ABI 373 performs automatic lane tracking and base-calling. The lane-tracking is confirmed visually. Each sequence electropherogram (or fluorescence lane trace) is inspected visually and assessed for quality. Trailing

sequences of low quality are removed and the sequence itself is loaded via software to a Sybase database (archived daily to 8mm tape). Leading vector polylinker sequence is removed automatically by a software program. Average edited lengths of sequences from the standard ABI 373 are around 400 bp and depend mostly on the quality of the template used for the sequencing reaction. ABI 373 Sequencers converted to Stretch Liners provide a longer electrophoresis path prior to fluorescence detection and increase the average number of usable bases to 500-600 bp.

## INFORMATICS

### 1. Data Management

A number of information management systems for a large-scale sequencing lab have been developed. (For review see, for instance, Kerlavage *et al.*, *Proceedings of the Twenty-Sixth Annual Hawaii International Conference on System Sciences*, IEEE Computer Society Press, Washington D. C., 585 (1993)) The system used to collect and assemble the sequence data was developed using the Sybase relational database management system and was designed to automate data flow wherever possible and to reduce user error. The database stores and correlates all information collected during the entire operation from template preparation to final analysis of the genome. Because the raw output of the ABI 373 Sequencers was based on a Macintosh platform and the data management system chosen was based on a Unix platform, it was necessary to design and implement a variety of multi- user, client-server applications which allow the raw data as well as analysis results to flow seamlessly into the database with a minimum of user effort.

### 2. Assembly

An assembly engine (TIGR Assembler) developed for the rapid and accurate assembly of thousands of sequence fragments was employed to generate contigs. The TIGR assembler simultaneously clusters and assembles fragments of the genome. In order to obtain the speed necessary to assemble more than  $10^4$  fragments, the algorithm builds a hash table of 12 bp oligonucleotide subsequences to generate a list of potential sequence fragment overlaps. The number of potential overlaps for each fragment determines which fragments are likely to fall into repetitive elements. Beginning with a single seed sequence fragment, TIGR Assembler extends the current contig by attempting to add the best matching

fragment based on oligonucleotide content. The contig and candidate fragment are aligned using a modified version of the Smith-Waterman algorithm which provides for optimal gapped alignments (Waterman, M. S., *Methods in Enzymology* 164:765 (1988)). The contig is extended by the fragment only if strict criteria for the quality of the match are met. The match criteria include the minimum length of overlap, the maximum length of an unmatched end, and the minimum percentage match. These criteria are automatically lowered by the algorithm in regions of minimal coverage and raised in regions with a possible repetitive element. The number of potential overlaps for each fragment determines which fragments are likely to fall into repetitive elements. Fragments representing the boundaries of repetitive elements and potentially chimeric fragments are often rejected based on partial mismatches at the ends of alignments and excluded from the current contig. TIGR Assembler is designed to take advantage of clone size information coupled with sequencing from both ends of each template. It enforces the constraint that sequence fragments from two ends of the same template point toward one another in the contig and are located within a certain range of base pairs (definable for each clone based on the known clone size range for a given library).

The process resulted in 391 contigs as represented by SEQ ID NOs:1-391.

### 3. Identifying Genes

The predicted coding regions of the *Streptococcus pneumoniae* genome were initially defined with the program GeneMark, which finds ORFs using a probabilistic classification technique. The predicted coding region sequences were used in searches against a database of all nucleotide sequences from GenBank (October, 1997), using the BLASTN search method to identify overlaps of 50 or more nucleotides with at least a 95% identity. Those ORFs with nucleotide sequence matches are shown in Table 1. The ORFs without such matches were translated to protein sequences and compared to a non-redundant database of known proteins generated by combining the Swiss-prot, PIR and GenPept databases. ORFs that matched a database protein with BLASTP probability less than or equal to 0.01 are shown in Table 2. The table also lists assigned functions based on the closest match in the databases. ORFs that did not match protein or nucleotide sequences in the databases at these levels are shown in Table 3.



## ILLUSTRATIVE APPLICATIONS

### 1. Production of an Antibody to a *Streptococcus pneumoniae* Protein

Substantially pure protein or polypeptide is isolated from the transfected or transformed cells using any one of the methods known in the art. The protein can also be produced in a recombinant prokaryotic expression system, such as *E. coli*, or can be chemically synthesized. Concentration of protein in the final preparation is adjusted, for example, by concentration on an Amicon filter device, to the level of a few micrograms/ml. Monoclonal or polyclonal antibody to the protein can then be prepared as follows.

### 2. Monoclonal Antibody Production by Hybridoma Fusion

Monoclonal antibody to epitopes of any of the peptides identified and isolated as described can be prepared from murine hybridomas according to the classical method of Kohler, G. and Milstein, C., *Nature* 256:495 (1975) or modifications of the methods thereof. Briefly, a mouse is repetitively inoculated with a few micrograms of the selected protein over a period of a few weeks. The mouse is then sacrificed, and the antibody producing cells of the spleen isolated. The spleen cells are fused by means of polyethylene glycol with mouse myeloma cells, and the excess unfused cells destroyed by growth of the system on selective media comprising aminopterin (HAT media). The successfully fused cells are diluted and aliquots of the dilution placed in wells of a microtiter plate where growth of the culture is continued. Antibody-producing clones are identified by detection of antibody in the supernatant fluid of the wells by immunoassay procedures, such as ELISA, as originally described by Engvall, E., *Meth. Enzymol.* 70:419 (1980), and modified methods thereof. Selected positive clones can be expanded and their monoclonal antibody product harvested for use. Detailed procedures for monoclonal antibody production are described in Davis, L. *et al.*, *Basic Methods in Molecular Biology*, Elsevier, New York. Section 21-2 (1989).

### 3. Polyclonal Antibody Production by Immunization

Polyclonal antiserum containing antibodies to heterogenous epitopes of a single protein can be prepared by immunizing suitable animals with the expressed protein described above, which can be unmodified or modified to enhance immunogenicity. Effective polyclonal antibody production is affected by many factors related both to the antigen and the host species. For example, small molecules tend to be less immunogenic than others and may require the use of carriers and adjuvant. Also, host animals vary in response to site of inoculations and dose, with both inadequate or excessive doses of antigen resulting in low titer antisera. Small doses (ng level) of antigen administered at multiple intradermal sites appears to be most reliable. An effective immunization protocol for rabbits can be found in Vaitukaitis, J. *et al.*, *J. Clin. Endocrinol. Metab.* 33:988-991 (1971).

Booster injections can be given at regular intervals, and antiserum harvested when antibody titer thereof, as determined semi-quantitatively, for example, by double immunodiffusion in agar against known concentrations of the antigen, begins to fall. See, for example, Ouchterlony, O. *et al.*, Chap. 19 in: *Handbook of Experimental Immunology*, Wier, D., ed, Blackwell (1973). Plateau concentration of antibody is usually in the range of 0.1 to 0.2 mg/ml of serum (about 12M). Affinity of the antisera for the antigen is determined by preparing competitive binding curves, as described, for example, by Fisher, D., Chap. 42 in: *Manual of Clinical Immunology*, second edition, Rose and Friedman, eds., Amer. Soc. For Microbiology, Washington, D. C. (1980)

Antibody preparations prepared according to either protocol are useful in quantitative immunoassays which determine concentrations of antigen-bearing substances in biological samples; they are also used semi- quantitatively or qualitatively to identify the presence of antigen in a biological sample. In addition, antibodies are useful in various animal models of pneumococcal disease as a means of evaluating the protein used to make the antibody as a potential vaccine target or as a means of evaluating the antibody as a potential immunotherapeutic or immunoprophylactic reagent.

#### 4. Preparation of PCR Primers and Amplification of DNA

Various fragments of the *Streptococcus pneumoniae* genome, such as those of Tables 1-3 and SEQ ID NOS:1-391 can be used, in accordance with the present invention, to prepare PCR primers for a variety of uses. The PCR primers are preferably at least 15 bases, and more preferably at least 18 bases in length. When selecting a primer sequence, it is preferred that the primer pairs have approximately the same G/C ratio, so that melting temperatures are approximately the same. The PCR primers and amplified DNA of this Example find use in the Examples that follow.

#### 5. Gene expression from DNA Sequences Corresponding to ORFs

A fragment of the *Streptococcus pneumoniae* genome provided in Tables 1-3 is introduced into an expression vector using conventional technology. Techniques to transfer cloned sequences into expression vectors that direct protein translation in mammalian, yeast, insect or bacterial expression systems are well known in the art. Commercially available vectors and expression systems are available from a variety of suppliers including Stratagene (La Jolla, California), Promega (Madison, Wisconsin), and Invitrogen (San Diego, California). If desired, to enhance expression and facilitate proper protein folding, the codon context and codon pairing of the sequence may be optimized for the particular expression organism, as explained by Hatfield *et al.*, U. S. Patent No. 5,082,767, incorporated herein by this reference.

The following is provided as one exemplary method to generate polypeptide(s) from cloned ORFs of the *Streptococcus pneumoniae* genome fragment. Bacterial ORFs generally lack a poly A addition signal. The addition signal sequence can be added to the construct by, for example, splicing out the poly A addition sequence from pSG5 (Stratagene) using BglI and SalI restriction endonuclease enzymes and incorporating it into the mammalian expression vector pXT1 (Stratagene) for use in eukaryotic expression systems. pXT1 contains the LTRs and a portion of the gag gene of Moloney Murine Leukemia Virus. The positions of the LTRs in the construct allow efficient stable transfection. The vector includes the Herpes Simplex thymidine kinase promoter and the selectable neomycin gene. The *Streptococcus pneumoniae* DNA is obtained by PCR from the bacterial vector using oligonucleotide primers complementary to the *Streptococcus pneumoniae* DNA and containing restriction endonuclease sequences for PstI incorporated into the 5' primer and BglII at the 5' end of the corresponding *Streptococcus pneumoniae* DNA 3' primer, taking care to ensure that the *Streptococcus pneumoniae* DNA is positioned such that its followed with the poly A addition sequence. The purified fragment obtained from the resulting PCR reaction is digested with PstI, blunt ended with an exonuclease, digested with BglII, purified and ligated to pXT1, now containing a poly A addition sequence and digested BglII.

The ligated product is transfected into mouse NIH 3T3 cells using Lipofectin (Life Technologies, Inc., Grand Island, New York) under conditions outlined in the product specification. Positive transfectants are selected after growing the transfected cells in 600 ug/ml G418 (Sigma, St. Louis, Missouri). The protein is preferably released into the supernatant. However if the protein has membrane binding domains, the protein may additionally be retained within the cell or expression may be restricted to the cell surface. Since it may be necessary to purify and locate the transfected product, synthetic 15-mer peptides synthesized from the predicted *Streptococcus pneumoniae* DNA sequence are injected into mice to generate antibody to the polypeptide encoded by the *Streptococcus pneumoniae* DNA.

Alternatively and if antibody production is not possible, the *Streptococcus pneumoniae* DNA sequence is additionally incorporated into eukaryotic expression vectors and expressed as, for example, a globin fusion. Antibody to the globin moiety then is used to purify the chimeric protein. Corresponding protease cleavage sites are engineered between the globin moiety and the polypeptide encoded by the *Streptococcus pneumoniae* DNA so that the latter may be freed from the formed by simple protease digestion. One useful expression vector for generating globin chimerics is pSG5 (Stratagene). This vector encodes a rabbit globin. Intron II of the rabbit globin gene facilitates splicing of the expressed transcript, and the polyadenylation signal incorporated into the construct increases the level of expression. These techniques are well known to those skilled in the art of molecular biology. Standard methods are published in methods texts such as Davis *et al.*, cited elsewhere herein, and many of the methods are available from the technical assistance representatives from Stratagene, Life Technologies, Inc., or Promega. Polypeptides of the invention also may be produced using *in vitro* translation systems such as *in vitro* Express™ Translation Kit (Stratagene).

While the present invention has been described in some detail for purposes of clarity and understanding, one skilled in the art will appreciate that various changes in form and detail can be made without departing from the true scope of the invention.

All patents, patent applications and publications referred to above are hereby incorporated by reference.

TABLE 1

S. pneumoniae - Coding regions containing known sequences

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	percent ident	HSP nt length	ORF nt length
1	1	437	1003	gb U41735	Streptococcus pneumoniae peptide methionine sulfoxide reductase (msrA) and homoserine kinase homolog (thrB) genes, complete cds	92	200	567
2	5	6169	5720	gb U04047	Streptococcus pneumoniae SS2 dextran glucosidase gene and insertion sequence IS1202 transposase gene, complete cds	96	450	450
2	6	6592	6167	emb 283335 SP28	S. pneumoniae dexB, cap1(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and allia gene	98	426	426
3	11	9770	9147	emb 283335 SP28	S. pneumoniae dexB, cap1(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and allia gene	94	624	624
3	12	10489	9671	emb 283335 SP28	S. pneumoniae dexB, cap1(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and allia gene	91	819	819
3	13	11546	12019	gb U43526	Streptococcus pneumoniae neuraminidase B (nanB) gene, complete cds, and neuraminidase (nana) gene, partial cds	99	474	474
3	14	12017	13375	gb U43526	Streptococcus pneumoniae neuraminidase B (nanB) gene, complete cds, and neuraminidase (nana) gene, partial cds	99	1359	1359
3	15	13421	14338	gb U43526	Streptococcus pneumoniae neuraminidase B (nanB) gene, complete cds, and neuraminidase (nana) gene, partial cds	99	918	918
3	16	14329	15171	gb U43526	Streptococcus pneumoniae neuraminidase B (nanB) gene, complete cds, and neuraminidase (nana) gene, partial cds	99	843	843
3	17	15132	17282	gb U43526	Streptococcus pneumoniae neuraminidase B (nanB) gene, complete cds, and neuraminidase (nana) gene, partial cds	99	2151	2151
3	18	17267	18397	gb U43526	Streptococcus pneumoniae neuraminidase B (nanB) gene, complete cds, and neuraminidase (nana) gene, partial cds	99	1069	1131
4	1	46	1188	emb Y11463 SPDN	Streptococcus pneumoniae dnaG, rpoD, cpoA genes and ORF3 and ORF5	99	1143	1143
4	2	1198	2529	emb Y11463 SPDN	Streptococcus pneumoniae dnaG, rpoD, cpoA genes and ORF3 and ORF5	99	876	1332
5	7	11297	11473	gb U41735	Streptococcus pneumoniae peptide methionine sulfoxide reductase (msrA) and homoserine kinase homolog (thrB) genes, complete cds	82	175	177
6	7	7125	7364	emb Z77726 SPIS	S. pneumoniae DNA for insertion sequence IS1318 (1372 bp)	93	238	240
6	8	7322	7570	emb Z77725 SPIS	S. pneumoniae DNA for insertion sequence IS1381 (966 bp)	95	160	249
6	9	7533	7985	emb Z77725 SPIS	S. pneumoniae DNA for insertion sequence IS1381 (966 bp)	99	453	453
6	23	20197	19733	emb 283335 SP28	S. pneumoniae dexB, cap1(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and allia gene	96	465	465
7	10	8305	7682	emb 283335 SP28	S. pneumoniae dexB, cap1(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and allia gene	95	624	624

**TABLE 1**  
S. pneumoniae - Coding regions containing known sequences

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	percent ident	HSP nt length	ORF nt length
7	11	9024	8206	emb Z83335 SP28	S.pneumoniae dexB, cap1(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and aliA gene	95	819	819
10	13	9304	8078	gb L29323	Streptococcus pneumoniae methyl transferase (mtr) gene cluster, complete cds	93	513	1227
11	2	548	919	emb Z79691 SOOR	S.pneumoniae yor1(A,B,C,D,E), ftsL, pbpX and regR genes	99	316	372
11	3	892	1980	emb Z79691 SOOR	S.pneumoniae yor1(A,B,C,D,E), ftsL, pbpX and regR genes	99	1089	1089
11	5	3040	3477	emb Z79691 SOOR	S.pneumoniae yor1(A,B,C,D,E), ftsL, pbpX and regR genes	99	259	438
11	6	3480	3247	emb Z79691 SOOR	S.pneumoniae yor1(A,B,C,D,E), ftsL, pbpX and regR genes	99	234	234
11	7	3601	4557	emb Z79691 SOOR	S.pneumoniae yor1(A,B,C,D,E), ftsL, pbpX and regR genes	98	957	957
11	8	4506	4886	emb Z79691 SOOR	S.pneumoniae yor1(A,B,C,D,E), ftsL, pbpX and regR genes	99	381	381
11	9	4884	7142	emb X16367 SPP8	Streptococcus pneumoniae pbpX gene for penicillin binding protein 2X	99	2259	2259
11	10	7132	8124	emb X16367 SPP8	Streptococcus pneumoniae pbpX gene for penicillin binding protein 2X	98	70	993
13	1	53	1126	gb M31296	S.pneumoniae recP gene, complete cds	99	437	1074
14	3	1837	2148	emb Z83335 SP28	S.pneumoniae dexB, cap1(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and aliA gene	87	96	312
14	4	2518	2108	gb M36180	Streptococcus pneumoniae transposase, (comA and comB) and SAICAR synthetase (putC) genes, complete cds	98	411	411
15	9	8942	8511	gb U09239	Streptococcus pneumoniae type 19F capsular polysaccharide biosynthesis operon, (cps19FABCEFGHIJKLMNO) genes, complete cds, and aliA gene, partial cds	89	340	432
17	7	3910	3458	emb Z77726 SP1S	S.pneumoniae DNA for insertion sequence IS1318 (1372 bp)	98	453	453
17	8	4304	3873	emb Z77727 SP1S	S.pneumoniae DNA for insertion sequence IS1318 (823 bp)	96	382	432
19	1	41	529	emb X94909 SP1G	S.pneumoniae iga gene	75	368	489
19	2	554	757	gb L07752	Streptococcus pneumoniae attachment site (attB), DNA sequence	99	167	204
19	3	946	1827	gb L07752	Streptococcus pneumoniae attachment site (attB), DNA sequence	94	100	882
20	1	937	182	gb U33315	Streptococcus pneumoniae orfL gene, partial cds, competence stimulating peptide precursor (comC), histidine protein kinase (comB) and response regulator (comE) genes, complete cds, tRNA-Arg and tRNA-Gln genes	99	756	756
20	2	2271	931	gb U33315	Streptococcus pneumoniae orfL gene, partial cds, competence stimulating peptide precursor (comC), histidine protein kinase (comB) and response regulator (comE) genes, complete cds, tRNA-Arg and tRNA-Gln genes	98	1341	1341

TABLE 1  
S. pneumoniae - Coding regions containing known sequences

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	percent ident	HSP nt length	ORF nt length
20	3	3175	2684	gb U76218	Streptococcus pneumoniae competence stimulating peptide precursor ComC (comC), histidine kinase homolog ComD (comD), and response regulator homolog ComE (comE) genes, complete cds	99	492	492
20	4	3322	4527	gb AF000658	Streptococcus pneumoniae R801 trna-Arg gene, partial sequence, and putative serine protease (sphtra), SPSPoj (spspoj), initiator protein (spdnaa) and beta subunit of DNA polymerase III (spdnai) genes, complete cds	99	1206	1206
20	5	4573	5343	gb AF000658	Streptococcus pneumoniae R801 trna-Arg gene, partial sequence, and putative serine protease (sphtra), SPSPoj (spspoj), initiator protein (spdnaa) and beta subunit of DNA polymerase III (spdnai) genes, complete cds	99	771	771
20	6	5532	6917	gb AF000658	Streptococcus pneumoniae R801 trna-Arg gene, partial sequence, and putative serine protease (sphtra), SPSPoj (spspoj), initiator protein (spdnaa) and beta subunit of DNA polymerase III (spdnai) genes, complete cds	99	1386	1386
20	7	6995	8212	gb AF000658	Streptococcus pneumoniae R801 trna-Arg gene, partial sequence, and putative serine protease (sphtra), SPSPoj (spspoj), initiator protein (spdnaa) and beta subunit of DNA polymerase III (spdnai) genes, complete cds	99	1218	1218
20	8	8214	8471	gb AF000658	Streptococcus pneumoniae R801 trna-Arg gene, partial sequence, and putative serine protease (sphtra), SPSPoj (spspoj), initiator protein (spdnaa) and beta subunit of DNA polymerase III (spdnai) genes, complete cds	98	258	258
20	9	8534	9670	gb AF000658	Streptococcus pneumoniae R801 trna-Arg gene, partial sequence, and putative serine protease (sphtra), SPSPoj (spspoj), initiator protein (spdnaa) and beta subunit of DNA polymerase III (spdnai) genes, complete cds	99	134	1137
22	14	11887	12267	emb 277726 SPIS	S.pneumoniae DNA for insertion sequence IS1318 (1372 bp)	99	226	381
22	15	12708	12256	emb 277727 SPIS	S.pneumoniae DNA for insertion sequence IS1318 (823 bp)	97	353	453
22	16	13165	12662	emb 277726 SPIS	S.pneumoniae DNA for insertion sequence IS1318 (1372 bp)	98	504	504
22	23	18398	18910	emb 286112 SP28	S.pneumoniae genes encoding galacturonosyl transferase and transposase and insertion sequence IS1515	95	463	513
22	24	18829	19299	emb 286112 SP28	S.pneumoniae genes encoding galacturonosyl transferase and transposase and insertion sequence IS1515	99	443	471
23	5	5624	4203	emb X52474 SPPL	S.pneumoniae ply gene for pneumolysin	99	1422	1422
23	6	6063	5629	gb H17717	S.pneumoniae pneumolysin gene, complete cds	98	197	435
26	1	5500	2	emb X94909 SPIG	S.pneumoniae iga gene	87	3487	5499
26	2	5823	5584	gb U47687	Streptococcus pneumoniae immunoglobulin A1 protease (iga) gene, complete cds	99	151	240
26	3	6878	5695	gb U47687	Streptococcus pneumoniae immunoglobulin A1 protease (iga) gene, complete cds	100	50	1194



**TABLE 1**  
S. pneumoniae - Coding regions containing known sequences

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	percent ident	HSP nt length	ORF nt length
26	8	14498	14854	emb 283335 SP28	S.pneumoniae dexB, caps A,B,C,D,E,F,G,H,I,J,K  genes, dTDP-rhamnose biosynthesis genes and allA gene	99	338	357
26	9	14763	14924	emb 283335 SP28	S.pneumoniae dexB, caps A,B,C,D,E,F,G,H,I,J,K  genes, dTDP-rhamnose biosynthesis genes and allA gene	100	94	162
26	10	14922	15173	gb U04047	Streptococcus pneumoniae SS2 dextran glucosidase gene and insertion sequence ISI202 transposase gene, complete cds	97	242	252
28	1	80	505	emb 283335 SP28	S.pneumoniae dexB, caps A,B,C,D,E,F,G,H,I,J,K  genes, dTDP-rhamnose biosynthesis genes and allA gene	99	426	426
28	2	503	952	gb U04047	Streptococcus pneumoniae SS2 dextran glucosidase gene and insertion sequence ISI202 transposase gene, complete cds	97	450	450
28	3	780	1298	gb U04047	Streptococcus pneumoniae SS2 dextran glucosidase gene and insertion sequence ISI202 transposase gene, complete cds	96	181	519
34	1	207	1523	gb L08611	Streptococcus pneumoniae maltose/maltodextrin uptake (malX) and two maltodextrin permease (malC and malD) genes, complete cds	99	1317	1317
34	2	1477	2367	gb L08611	Streptococcus pneumoniae maltose/maltodextrin uptake (malX) and two maltodextrin permease (malC and malD) genes, complete cds	96	795	891
34	3	2593	3420	gb L21856	Streptococcus pneumoniae malA gene, complete cds; malR gene, complete cds	96	446	828
34	4	2790	2647	gb L21856	Streptococcus pneumoniae malA gene, complete cds; malR gene, complete cds	98	137	144
34	5	3418	4416	gb L21856	Streptococcus pneumoniae malA gene, complete cds; malR gene, complete cds	96	999	999
34	9	7764	7507	gb U41735	Streptococcus pneumoniae peptide methionine sulfoxide reductase (marA) and homoserine kinase homolog (thrB) genes, complete cds	93	201	258
34	16	10562	10257	emb X63602 SP80	S.pneumoniae msaA-Box	92	238	306
35	4	1176	1439	emb 283335 SP28	S.pneumoniae dexB, caps A,B,C,D,E,F,G,H,I,J,K  genes, dTDP-rhamnose biosynthesis genes and allA gene	87	248	264
35	5	1458	1961	gb U09239	Streptococcus pneumoniae type 19F capsular polysaccharide biosynthesis operon, (cps19FABCD EFGHIJ KLMNO) genes, complete cds, and allA gene, partial cds	98	264	504
35	17	16172	15477	emb X85787 SPCP	S.pneumoniae dexB, cps14A, cps14B, cps14C, cps14D, cps14E, cps14F, cps14G, cps14H, cps14I, cps14J, cps14K, cps14L, cps14M, cps14N, cps14O genes	97	696	696
35	18	16961	16170	emb 283335 SP28	S.pneumoniae dexB, caps A,B,C,D,E,F,G,H,I,J,K  genes, dTDP-rhamnose biosynthesis genes and allA gene	86	792	792
35	19	17620	16871	gb U09239	Streptococcus pneumoniae type 19F capsular polysaccharide biosynthesis operon, (cps19FABCD EFGHIJ KLMNO) genes, complete cds, and allA gene, partial cds	83	750	750

TABLE 1  
S. pneumoniae - Coding regions containing known sequences

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	percent ident	HSP nt length	ORF nt length
35	20	19061	17604	emb X85787 SPCP	S.pneumoniae dexB, cps14A, cps14B, cps14C, cps14D, cps14E, cps14F, cps14G, cps14H, cps14I, cps14J, cps14K, cps14L, taaA genes	94	1458	1458
36	19	18960	18352	gb U40786	Streptococcus pneumoniae surface antigen A variant precursor (psaA) and 18 kDa protein genes, complete cds, and ORF1 gene, partial cds	99	609	609
36	20	19934	18966	gb U53509	Streptococcus pneumoniae surface adhesin A precursor (psaA) gene, complete cds	99	969	969
37	1	2743	179	emb Z67739 SPPA	S.pneumoniae parC, parE and transposase genes and unknown orf	99	2565	2565
37	2	2985	2824	emb Z67739 SPPA	S.pneumoniae parC, parE and transposase genes and unknown orf	100	162	162
37	3	5034	3070	emb Z67739 SPPA	S.pneumoniae parC, parE and transposase genes and unknown orf	99	1965	1965
37	4	5134	5790	emb Z67739 SPPA	S.pneumoniae parC, parE and transposase genes and unknown orf	99	657	657
37	5	6171	5833	emb Z67739 SPPA	S.pneumoniae parC, parE and transposase genes and unknown orf	96	339	339
38	19	12969	13268	gb H28679	S.pneumoniae promoter region DNA	100	64	300
39	2	1256	2137	gb U41735	Streptococcus pneumoniae peptide methionine sulfoxide reductase (msrA) and homoserine kinase homolog (thrB) genes, complete cds	99	882	882
39	3	2405	3370	gb U41735	Streptococcus pneumoniae peptide methionine sulfoxide reductase (msrA) and homoserine kinase homolog (thrB) genes, complete cds	99	966	966
40	9	5253	7208	gb H29686	S.pneumoniae mismatch repair (hexB) gene, complete cds	99	1956	1956
41	1	3	1037	emb Z17307 SPRE	S.pneumoniae recA gene encoding RecA	99	1027	1035
41	2	1328	2713	emb Z34303 SPCI	Streptococcus pneumoniae cin operon encoding the cinA, recA, dinF, lytA genes, and downstream sequences	99	1386	1386
41	3	3083	4045	gb H13812	S.pneumoniae autolysin (lytA) gene, complete cds	99	963	963
41	4	3272	3096	gb H13812	S.pneumoniae autolysin (lytA) gene, complete cds	100	177	177
41	5	3603	3860	gb H13812	S.pneumoniae autolysin (lytA) gene, complete cds	100	258	258
41	6	4755	5162	gb L36660	Streptococcus pneumoniae ORF, complete cds	98	408	408
41	7	5270	5716	gb L36660	Streptococcus pneumoniae ORF, complete cds	98	447	447
41	8	6112	6918	gb L36660	Streptococcus pneumoniae ORF, complete cds	98	431	807
41	9	6916	7119	gb L36660	Streptococcus pneumoniae ORF, complete cds	100	204	204
41	10	7082	7660	gb L36660	Streptococcus pneumoniae ORF, complete cds	97	552	579
41	11	7680	7979	gb L36660	Streptococcus pneumoniae ORF, complete cds	98	81	300
41	12	9169	8717	emb Z77727 SPIS	S.pneumoniae DNA for insertion sequence IS1318 (823 bp)	97	353	453

TABLE 1

S. pneumoniae - Coding regions containing known sequences

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	percent ident	HSP nt length	ORF nt length
41	13	9533	9132	emb Z77725 SP1S	S.pneumoniae DNA for insertion sequence IS1381 (966 bp)	95	160	402
41	14	9669	9475	emb Z82001 SP28	S.pneumoniae pcps gene and open reading frames	100	189	195
44	5	7190	7555	emb Z82001 SP28	S.pneumoniae pcps gene and open reading frames	99	366	366
44	6	8059	7607	emb Z77726 SP1S	S.pneumoniae DNA for insertion sequence IS1318 (1372 bp)	97	453	453
44	7	8423	8022	emb Z77725 SP1S	S.pneumoniae DNA for insertion sequence IS1381 (966 bp)	95	160	402
44	8	8559	8365	emb Z82001 SP28	S.pneumoniae pcps gene and open reading frames	100	189	195
48	9	6480	4687	gb L39074	Streptococcus pneumoniae pyruvate oxidase (spox) gene, complete cds	99	1794	1794
49	2	231	2603	gb L20561	Streptococcus pneumoniae Exp7 gene, partial cds	100	216	2373
53	6	2407	2156	gb U04047	Streptococcus pneumoniae SS2 dextran glucosidase gene and insertion sequence IS1202 transposase gene, complete cds	97	242	252
53	7	2566	2405	emb Z83335 SP28	S.pneumoniae dexB, cap1(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and allia gene	100	94	162
53	8	2631	2475	emb Z83335 SP28	S.pneumoniae dexB, cap1(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and allia gene	99	338	357
54	13	12409	11105	emb Z83335 SP28	S.pneumoniae dexB, cap1(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and allia gene	67	591	1305
55	22	20488	19949	emb Z84379 HS28	S.pneumoniae dfr gene (isolate 92)	99	540	540
61	11	11864	9900	emb Z16082 PNAL	Streptococcus pneumoniae allB gene	98	1965	1965
63	1	3	239	gb M18729	S.pneumoniae mismatch repair protein (hexA) gene, complete cds	100	237	237
63	2	233	2611	gb M18729	S.pneumoniae mismatch repair protein (hexA) gene, complete cds	99	2330	2379
63	3	2557	2823	gb M18729	S.pneumoniae mismatch repair protein (hexA) gene, complete cds	99	266	267
63	4	2958	4664	gb M18729	S.pneumoniae mismatch repair protein (hexA) gene, complete cds	95	69	1707
67	6	3770	3399	gb L20670	Streptococcus pneumoniae hyaluronidase gene, complete cds	96	372	372
67	7	7161	4171	gb L20670	Streptococcus pneumoniae hyaluronidase gene, complete cds	99	2938	2991
70	1	1	702	gb M14340	S.pneumoniae DpnI gene region encoding dpmC and dpmD, complete cds	100	693	702
70	2	678	1160	gb M14340	S.pneumoniae DpnI gene region encoding dpmC and dpmD, complete cds	100	483	483
70	3	2490	1210	gb M14339	S.pneumoniae DpnII gene region encoding dpmI, dpmA, dpmB, complete cds	98	462	1281
70	7	4230	4424	gb J04234	S.pneumoniae exodeoxyribonuclease (exoA) gene, complete cds	99	147	195
70	8	5197	4316	gb J04234	S.pneumoniae exodeoxyribonuclease (exoA) gene, complete cds	99	881	882

TABLE 1

S. pneumoniae - Coding regions containing known sequences

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	percent ident	HSP nt length	ORF nt length
70	13	8108	9874	gb J20562	Streptococcus pneumoniae Exp8 gene, partial cds	93	234	1767
71	22	27964	28341	emb X63602 SP80	S. pneumoniae mmsA-Box	93	233	378
72	5	4607	3552	emb 226850 SPAT	S. pneumoniae (M222) genes for ATPase a subunit, ATPase b subunit and ATPase c subunit	97	102	1056
73	1	471	133	emb X63602 SP80	S. pneumoniae mmsA-Box	91	193	339
73	3	3658	977	gb J04479	S. pneumoniae DNA polymerase I (polA) gene, complete cds	99	2682	2682
73	8	4864	5379	gb M36180	Streptococcus pneumoniae transposase, (comA and comB) and SAICAR synthetase (purC) genes, complete cds	98	318	516
77	3	2622	1999	emb 283335 SP28	S. pneumoniae dexB, cap1(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and alia gene	95	624	624
77	4	3341	2523	emb 283335 SP28	S. pneumoniae dexB, cap1(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and alia gene	91	819	819
78	1	341	3	emb X77249 SP6	S. pneumoniae (R6) clar/ciaH genes	99	339	339
78	2	1095	325	emb X77249 SP6	S. pneumoniae (R6) clar/ciaH genes	99	771	771
82	10	11436	10816	gb U90721	Streptococcus pneumoniae signal peptidase I (spi) gene, complete cds	97	621	621
82	11	12402	11434	gb U93576	Streptococcus pneumoniae ribonuclease HII (rnhB) gene, complete cds	98	953	969
82	12	12381	12704	gb U93576	Streptococcus pneumoniae ribonuclease HII (rnhB) gene, complete cds	100	51	324
83	8	3212	3550	emb 277727 SP15	S. pneumoniae DNA for insertion sequence IS1318 (823 bp)	97	290	339
83	10	4662	6851	gb M36180	Streptococcus pneumoniae transposase, (comA and comB) and SAICAR synthetase (purC) genes, complete cds	99	2190	2190
83	11	6849	8213	gb M36180	Streptococcus pneumoniae transposase, (comA and comB) and SAICAR synthetase (purC) genes, complete cds	99	1365	1365
83	12	8236	9090	gb M36180	Streptococcus pneumoniae transposase, (comA and comB) and SAICAR synthetase (purC) genes, complete cds	99	855	855
83	13	9283	13017	gb L15190	Streptococcus pneumoniae SAICAR synthetase (purC) gene, complete cds	100	107	3735
83	23	22147	23313	gb L36923	Streptococcus pneumoniae beta-N-acetylhexosaminidase (strH) gene, complete cds	98	218	1167
83	24	23268	23450	gb L36923	Streptococcus pneumoniae beta-N-acetylhexosaminidase (strH) gene, complete cds	98	172	183
83	25	27527	23505	gb L36923	Streptococcus pneumoniae beta-N-acetylhexosaminidase (strH) gene, complete cds	99	3826	4023

TABLE 1  
S. pneumoniae - Coding regions containing known sequences

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	percent ident	HSP nt length	ORF nt length
83	26	28472	27771	gb L36923	Streptococcus pneumoniae beta-N-acetylhexosaminidase (strH) gene, complete cds	99	416	702
84	4	4554	6173	emb 283335 SP28	S.pneumoniae dexB, cap1(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and allA gene	98	697	1620
87	6	5951	5316	emb 277725 SP15	S.pneumoniae DNA for insertion sequence IS1381 (966 bp)	96	439	636
88	5	2957	3511	gb H36180	Streptococcus pneumoniae transposase, (comA and comB) and SAICAR synthetase (purC) genes, complete cds	94	555	555
88	6	3466	4269	gb H36180	Streptococcus pneumoniae transposase, (comA and comB) and SAICAR synthetase (purC) genes, complete cds	94	804	804
89	13	9878	10093	gb H36180	Streptococcus pneumoniae transposase, (comA and comB) and SAICAR synthetase (purC) genes, complete cds	97	211	216
89	14	10062	10412	emb 283335 SP28	S.pneumoniae dexB, cap1(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and allA gene	97	335	351
93	10	5303	4941	emb X63602 SP80	S.pneumoniae mmsA-Box	89	237	363
97	4	1708	1520	gb U41735	Streptococcus pneumoniae peptide methionine sulfoxide reductase (marA) and homoserine kinase homolog (thrB) genes, complete cds	91	140	189
99	1	89	700	emb 283335 SP28	S.pneumoniae dexB, cap1(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and allA gene	93	592	612
99	2	1773	775	emb X17337 SPAM	Streptococcus pneumoniae ami locus conferring aminopterin resistance	99	998	999
99	3	2794	1712	emb X17337 SPAM	Streptococcus pneumoniae ami locus conferring aminopterin resistance	99	1083	1083
99	4	3732	2788	emb X17337 SPAM	Streptococcus pneumoniae ami locus conferring aminopterin resistance	100	945	945
99	5	5249	3714	emb X17337 SPAM	Streptococcus pneumoniae ami locus conferring aminopterin resistance	100	1536	1536
99	6	7262	5277	emb X17337 SPAM	Streptococcus pneumoniae ami locus conferring aminopterin resistance	99	1986	1986
101	1	216	1538	emb X54225 SPEN	S.pneumoniae epuA and endA genes for 7 kDa protein and membrane endonuclease	99	146	1323
101	2	1492	1719	emb X54225 SPEN	S.pneumoniae epuA and endA genes for 7 kDa protein and membrane endonuclease	99	228	228
101	3	1694	1855	emb X54225 SPEN	S.pneumoniae epuA and endA genes for 7 kDa protein and membrane endonuclease	100	162	162
101	4	1701	2582	emb X54225 SPEN	S.pneumoniae epuA and endA genes for 7 kDa protein and membrane endonuclease	100	882	882
103	7	5556	5041	emb 295914 SP29	Streptococcus pneumoniae soda gene	100	396	516
104	2	1347	1556	emb 277727 SP15	S.pneumoniae DNA for insertion sequence IS1318 (823 bp)	83	206	210

TABLE I

S. pneumoniae - Coding regions containing known sequences

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	percent ident	HSP nt length	ORF nt length
105	5	5381	5028	emb 267739 SPPA	S.pneumoniae parC, parE and transposase genes and unknown orf	98	353	354
105	6	6089	5379	emb 267739 SPPA	S.pneumoniae parC, parE and transposase genes and unknown orf	98	84	711
107	4	2785	1880	emb X16022 SPPE	S.pneumoniae penA gene	98	72	906
107	5	2913	4988	emb X16022 SPPE	S.pneumoniae penA gene	99	1692	2076
107	6	4981	5595	emb X13136 SPPE	Streptococcus pneumoniae penA gene for penicillin binding protein 2B lacking N-term. (penicillin resistant strain)	91	107	615
108	9	9068	8718	emb 267739 SPPA	S.pneumoniae parC, parE and transposase genes and unknown orf	95	142	351
108	12	11308	10922	emb 267739 SPPA	S.pneumoniae parC, parE and transposase genes and unknown orf	99	199	387
109	3	2768	2241	emb 277725 SPIS	S.pneumoniae DNA for insertion sequence IS1381 (966 bp)	96	61	528
109	4	2688	2855	emb 277726 SPIS	S.pneumoniae DNA for insertion sequence IS1318 (1372 bp)	96	148	168
109	5	2862	3269	emb 277727 SPIS	S.pneumoniae DNA for insertion sequence IS1318 (823 bp)	97	353	408
109	6	5320	3584	gb H18729	S.pneumoniae mismatch repair protein (hexA) gene, complete cds	100	371	1737
113	1	431	3	gb M36180	Streptococcus pneumoniae transposase, (comA and comB) and SAICAR synthetase (purC) genes, complete cds	95	429	429
113	10	9788	8532	emb X99400 SPDA	S.pneumoniae dacA gene and ORF	99	1257	1257
113	11	9870	10985	emb X99400 SPDA	S.pneumoniae dacA gene and ORF	99	1116	1116
114	3	2530	2030	gb M36180	Streptococcus pneumoniae transposase, (comA and comB) and SAICAR synthetase (purC) genes, complete cds	95	481	501
115	11	11303	10932	gb U04047	Streptococcus pneumoniae SSZ dextran glucosidase gene and insertion sequence IS1202 transposase gene, complete cds	97	372	372
117	1	897	3302	emb X72967 SPNA	S.pneumoniae nanA gene	99	2402	2406
117	2	3277	3831	emb X72967 SPNA	S.pneumoniae nanA gene	99	237	555
117	3	4327	3899	gb M36180	Streptococcus pneumoniae transposase, (comA and comB) and SAICAR synthetase (purC) genes, complete cds	98	429	429
121	2	1369	1941	gb U72720	Streptococcus pneumoniae heat shock protein 70 (dnaK) gene, complete cds and DnaJ (dnaJ) gene, partial cds	99	202	573
121	3	2412	4253	gb U72720	Streptococcus pneumoniae heat shock protein 70 (dnaK) gene, complete cds and DnaJ (dnaJ) gene, partial cds	99	1842	1842
122	8	5066	5587	gb U04047	Streptococcus pneumoniae SSZ dextran glucosidase gene and insertion sequence IS1202 transposase gene, complete cds	64	451	522

TABLE 1

S. pneumoniae - Coding regions containing known sequences

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	percent ident	HSP nt length	ORF nt length
125	1	1811	189	gb H36180	Streptococcus pneumoniae transposase, (comA and comB) and SAICAR synthetase (purC) genes, complete cds	92	99	1623
128	15	12496	11204	emb Z83335 SP28	S.pneumoniae dexB, capl(A,B,C,D,E,F,G,H,I,J,K) genes, dtdp-rhamnose biosynthesis genes and alia gene	91	705	1293
134	1	1	492	emb Y10818 SPY1	S.pneumoniae spsA gene	99	203	492
134	2	556	2652	gb AF019904	Streptococcus pneumoniae choline binding protein A (cbpA) gene, partial cds	86	685	2097
134	3	1160	837	emb Y10818 SPY1	S.pneumoniae spsA gene	86	324	324
134	4	3952	2882	gb AF019904	Streptococcus pneumoniae choline binding protein A (cbpA) gene, partial cds	98	215	1071
134	8	7992	9848	gb U12567	Streptococcus pneumoniae P13 glycerol-3-phosphate dehydrogenase (glpD) gene, partial cds, and glycerol uptake facilitator (glpF) and ORF3 genes, complete cds	99	285	1857
134	9	9846	10622	gb U12567	Streptococcus pneumoniae P13 glycerol-3-phosphate dehydrogenase (glpD) gene, partial cds, and glycerol uptake facilitator (glpF) and ORF3 genes, complete cds	99	570	777
134	10	10805	11122	gb U12567	Streptococcus pneumoniae P13 glycerol-3-phosphate dehydrogenase (glpD) gene, partial cds, and glycerol uptake facilitator (glpF) and ORF3 genes, complete cds	100	318	318
137	13	7970	8443	gb U09239	Streptococcus pneumoniae type 19F capsular polysaccharide biosynthesis operon, (cpsA,cpsB,cpsC,cpsD,cpsE,cpsF,cpsG,cpsH,cpsI,cpsJ,cpsK,cpsL,cpsM,cpsN,cpsO,cpsP,cpsQ,cpsR,cpsS,cpsT,cpsU,cpsV,cpsW,cpsX,cpsY,cpsZ,cpsA,cpsB,cpsC,cpsD,cpsE,cpsF,cpsG,cpsH,cpsI,cpsJ,cpsK,cpsL,cpsM,cpsN,cpsO,cpsP,cpsQ,cpsR,cpsS,cpsT,cpsU,cpsV,cpsW,cpsX,cpsY,cpsZ) genes, complete cds, and alia gene, partial cds	90	420	474
137	14	8590	8775	emb Z83335 SP28	S.pneumoniae dexB, capl(A,B,C,D,E,F,G,H,I,J,K) genes, dtdp-rhamnose biosynthesis genes and alia gene	94	174	186
137	15	8773	8967	emb Z83335 SP28	S.pneumoniae dexB, capl(A,B,C,D,E,F,G,H,I,J,K) genes, dtdp-rhamnose biosynthesis genes and alia gene	98	195	195
137	16	9223	9687	emb Z77726 SP15	S.pneumoniae DNA for insertion sequence IS1318 (1372 bp)	96	446	465
137	17	9641	10051	emb Z77727 SP15	S.pneumoniae DNA for insertion sequence IS1318 (823 bp)	96	293	411
139	10	12998	12702	emb X63602 SPB0	S.pneumoniae mmsA-Box	90	234	297
141	8	7805	8938	emb Z49988 SPHM	Streptococcus pneumoniae mmsA gene	99	338	1134
141	9	8936	10972	emb Z49988 SPHM	Streptococcus pneumoniae mmsA gene	99	2037	2037
141	10	11472	12467	emb Z49988 SPHM	Streptococcus pneumoniae mmsA gene	100	76	996
142	2	257	814	gb H80215	Streptococcus pneumoniae uvs402 protein gene, complete cds	98	174	558
142	3	787	957	gb H80215	Streptococcus pneumoniae uvs402 protein gene, complete cds	100	142	171
142	4	980	3022	gb H80215	Streptococcus pneumoniae uvs402 protein gene, complete cds	95	1997	2043

TABLE 1

S. pneumoniae - Coding regions containing known sequences

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	percent ident	HSP nt length	ORF nt length
142	5	3030	3595	gb H80215	Streptococcus pneumoniae uvs402 protein gene, complete cds	100	153	576
145	1	1	219	emb 235135 SPAL	S.pneumoniae alia gene for amIA-like gene A	97	185	219
145	2	171	1994	gb L20556	Streptococcus pneumoniae plpA gene, partial cds	99	1811	1824
145	3	2287	7599	emb 247210 SPDE	S.pneumoniae dexB, cap3A, cap3B and cap3C genes and orfs	99	1052	5313
145	4	9934	7766	gb H90527	Streptococcus pneumoniae penicillin-binding protein (ponA) gene, complete cds	99	2169	2169
145	5	10488	9922	gb H90527	Streptococcus pneumoniae penicillin-binding protein (ponA) gene, complete cds	99	512	567
146	1	159	4	emb 282002 SP28	S.pneumoniae pcgB and pcgC genes	98	156	156
146	2	344	90	emb 282002 SP28	S.pneumoniae pcgB and pcgC genes	98	255	255
146	16	11795	10794	emb 282002 SP28	S.pneumoniae pcgB and pcgC genes	85	276	1002
147	11	10678	10202	emb 221702 SPUN	S.pneumoniae ung gene and mutX genes encoding uracil-DNA glycosylase and 8-oxodGTP nucleoside triphosphatase	98	477	477
147	12	11138	10676	emb 221702 SPUN	S.pneumoniae ung gene and mutX genes encoding uracil-DNA glycosylase and 8-oxodGTP nucleoside triphosphatase	99	663	663
148	12	9009	8815	gb J041735	Streptococcus pneumoniae peptide methionine sulfoxide reductase (msrA) and homoserine kinase homolog (thrB) genes, complete cds	90	180	195
156	4	1154	1402	emb X63602 SPBO	S.pneumoniae mmsA-Box	94	185	249
159	13	9048	8521	gb X36180	Streptococcus pneumoniae transposase, (comA and comB) and SAICAR synthetase (purC) genes, complete cds	98	526	528
160	1	1	147	emb 226851 SPAT	S.pneumoniae (R6) genes for ATPase a subunit, ATPase b subunit and ATPase c subunit	100	142	147
160	2	179	898	emb 226851 SPAT	S.pneumoniae (R6) genes for ATPase a subunit, ATPase b subunit and ATPase c subunit	99	720	720
160	3	906	1406	emb 226850 SPAT	S.pneumoniae (H222) genes for ATPase a subunit, ATPase b subunit and ATPase c subunit	95	501	501
160	4	1373	1942	emb 226850 SPAT	S.pneumoniae (H222) genes for ATPase a subunit, ATPase b subunit and ATPase c subunit	87	306	570
161	1	1	984	emb X77249 SPR6	S.pneumoniae (R6) cfaH/ciaH genes	99	984	984
161	7	6910	7497	emb X83917 SPGY	S.pneumoniae orfgyrB and gyrB gene encoding DNA gyrase B subunit	99	437	588
161	8	7443	9386	emb X83917 SPGY	S.pneumoniae orfgyrB and gyrB gene encoding DNA gyrase B subunit	98	1912	1944
163	1	2	2155	gb L20559	Streptococcus pneumoniae Exp5 gene, partial cds	98	327	2154



TABLE 1  
S. pneumoniae - Coding regions containing known sequences

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	percent ident	HSP nt length	ORF nt length
165	1	32	1618	gb J01796	S.pneumoniae malX and malM genes encoding membrane protein and amyloamylase, complete cds, and malP gene encoding phosphorylase	99	1587	1587
165	2	1608	3902	gb J01796	S.pneumoniae malX and malM genes encoding membrane protein and amyloamylase, complete cds, and malP gene encoding phosphorylase	100	280	2295
166	1	378	4	emb Y11463 SPDN	Streptococcus pneumoniae dnaG, rpoD, cpoA genes and ORF3 and ORF5	100	375	375
166	2	1507	320	emb Y11463 SPDN	Streptococcus pneumoniae dnaG, rpoD, cpoA genes and ORF3 and ORF5	99	1188	1188
166	3	3240	1432	emb Y11463 SPDN	Streptococcus pneumoniae dnaG, rpoD, cpoA genes and ORF3 and ORF5	99	563	1809
167	1	1077	328	emb Z71552 SPAD	Streptococcus pneumoniae dnaG, rpoD, cpoA genes and ORF3 and ORF5	94	155	750
167	2	1844	999	emb Z71552 SPAD	Streptococcus pneumoniae dnaG, rpoD, cpoA genes and ORF3 and ORF5	98	405	846
167	3	2714	1842	emb Z71552 SPAD	Streptococcus pneumoniae dnaG, rpoD, cpoA genes and ORF3 and ORF5	97	604	873
167	4	3399	2641	emb Z71552 SPAD	Streptococcus pneumoniae dnaG, rpoD, cpoA genes and ORF3 and ORF5	99	703	759
168	1	1	2259	gb U20550	Streptococcus pneumoniae Exp4 gene, partial cds	99	282	2259
170	10	7138	7685	emb Z77726 SPIS	S.pneumoniae DNA for insertion sequence IS1318 (1372 bp)	95	315	348
172	6	2462	4981	gb U47625	Streptococcus pneumoniae formate acetyltransferase (exp72) gene, partial cds	97	365	2520
175	1	373	20	gb M36180	Streptococcus pneumoniae transposase, (comA and comB) and SAICAR synthetase (purC) genes, complete cds	89	353	354
175	4	1843	3621	emb Z47210 SPDB	S.pneumoniae dexB, cap3A, cap3B and cap3C genes and orfs	95	89	1779
176	5	3984	2980	emb Z67739 SPPA	S.pneumoniae parC, parE and transposase genes and unknown orf	100	573	1005
178	1	3	425	emb Z67739 SPPA	S.pneumoniae parC, parE and transposase genes and unknown orf	95	423	423
179	1	426	70	emb Z83335 SP28	S.pneumoniae dexB, cap1(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and alia gene	99	338	357
180	3	3084	1855	emb X95718 SPGY	S.pneumoniae gyrA gene	99	381	1230
186	1	714	4	emb Z79691 SOOR	S.pneumoniae ynf(A,B,C,D,E), ftsL, pbpX and regR genes	98	59	711
186	2	2254	608	emb Z79691 SOOR	S.pneumoniae ynf(A,B,C,D,E), ftsL, pbpX and regR genes	98	315	1647
186	3	707	880	emb Z79691 SOOR	S.pneumoniae ynf(A,B,C,D,E), ftsL, pbpX and regR genes	98	174	174
189	1	2	259	gb U72720	Streptococcus pneumoniae heat shock protein 70 (dnaK) gene, complete cds and dnaJ (dnaJ) gene, partial cds	99	258	258
189	2	600	385	gb U72720	Streptococcus pneumoniae heat shock protein 70 (dnaK) gene, complete cds and dnaJ (dnaJ) gene, partial cds	98	204	216

TABLE 1

S. pneumoniae - Coding regions containing known sequences

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	percent ident	HSP nt length	ORF nt length
189	3	1018	851	gb U72720	Streptococcus pneumoniae heat shock protein 70 (dnaK) gene, complete cds and DnaJ (dnaJ) gene, partial cds	99	168	168
189	4	1012	2154	gb U72720	Streptococcus pneumoniae heat shock protein 70 (dnaK) gene, complete cds and DnaJ (dnaJ) gene, partial cds	99	1062	1143
191	9	7829	7524	emb X63602 SP80	S. pneumoniae mmsA-Box	95	234	306
194	1	1	729	gb M36180	Streptococcus pneumoniae transposase, (comA and comB) and SAICAR synthetase (purC) genes, complete cds	91	728	729
199	2	1117	881	emb Z83335 SP28	S. pneumoniae dexB, capl(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and allA gene	96	211	237
199	4	1499	1762	emb Z83335 SP28	S. pneumoniae dexB, capl(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and allA gene	89	248	264
199	5	1781	2284	emb Z83335 SP28	S. pneumoniae dexB, capl(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and allA gene	98	504	504
203	1	1977	337	gb L20563	Streptococcus pneumoniae Exp9 gene, partial cds	99	342	1641
204	1	1145	3	gb L36131	Streptococcus pneumoniae exp10 gene, complete cds, recA gene, 5' and	99	1143	1143
208	1	59	2296	gb U89711	Streptococcus pneumoniae pneumococcal surface protein A PspA (pspA) gene, complete cds	90	471	2238
213	3	2455	2123	emb Z83335 SP28	S. pneumoniae dexB, capl(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and allA gene	96	332	333
216	1	368	12	emb Z83335 SP28	S. pneumoniae dexB, capl(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and allA gene	99	338	357
216	3	2650	2327	gb M28678	S. pneumoniae promoter sequence DNA	98	86	324
222	1	417	4	emb Z83335 SP28	S. pneumoniae dexB, capl(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and allA gene	94	414	414
227	3	5266	4238	emb AJ000336 SP	Streptococcus pneumoniae ldh gene	99	1029	1029
239	1	1	804	gb M31296	S. pneumoniae recP gene, complete cds	95	484	804
247	3	1625	1807	gb M36180	Streptococcus pneumoniae transposase, (comA and comB) and SAICAR synthetase (purC) genes, complete cds	94	178	183
249	3	921	1364	emb Z83335 SP28	S. pneumoniae dexB, capl(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and allA gene	94	443	444
253	1	362	3	gb M36180	Streptococcus pneumoniae transposase, (comA and comB) and SAICAR synthetase (purC) genes, complete cds	99	360	360
253	5	1238	2050	emb Z83335 SP28	S. pneumoniae dexB, capl(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and allA gene	95	420	813

TABLE 1  
S. pneumoniae - Coding regions containing known sequences

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	percent ident	HSP nt length	ORF nt length
253	6	2069	2572	emb 283335 SP28	S.pneumoniae dexB, capI(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and aIIA gene	97	504	504
255	1	3	800	emb 282002 SP28	S.pneumoniae pcg8 and pcgC genes	97	531	798
255	2	798	1841	emb 282002 SP28	S.pneumoniae pcg8 and pcgC genes	97	672	1044
255	3	2493	1969	emb 267739 SPPA	S.pneumoniae parC, parE and transposase genes and unknown orf	92	435	525
257	2	985	770	emb X17337 SPAH	Streptococcus pneumoniae ani locus conferring aminopterin resistance	96	117	216
257	3	1245	907	gb M36180	Streptococcus pneumoniae transposase, (comA and comB) and SAICAR synthetase (purC) genes, complete cds	97	339	339
267	2	495	1208	gb U16156	Streptococcus pneumoniae dihydropterolate synthase (sulA), dihydrofolate synthetase (sulB), guanosine triphosphate cyclohydrolase (sulC), aldolase-pyrophosphokinase (sulD) genes, complete cds	95	84	714
267	3	1291	2277	gb U16156	Streptococcus pneumoniae dihydropterolate synthase (sulA), dihydrofolate synthetase (sulB), guanosine triphosphate cyclohydrolase (sulC), aldolase-pyrophosphokinase (sulD) genes, complete cds	97	755	987
267	4	2261	3601	gb U16156	Streptococcus pneumoniae dihydropterolate synthase (sulA), dihydrofolate synthetase (sulB), guanosine triphosphate cyclohydrolase (sulC), aldolase-pyrophosphokinase (sulD) genes, complete cds	98	1341	1341
267	5	3561	4136	gb U16156	Streptococcus pneumoniae dihydropterolate synthase (sulA), dihydrofolate synthetase (sulB), guanosine triphosphate cyclohydrolase (sulC), aldolase-pyrophosphokinase (sulD) genes, complete cds	99	576	576
267	6	4164	4949	gb U16156	Streptococcus pneumoniae dihydropterolate synthase (sulA), dihydrofolate synthetase (sulB), guanosine triphosphate cyclohydrolase (sulC), aldolase-pyrophosphokinase (sulD) genes, complete cds	99	748	786
267	7	5544	5140	gb U16156	Streptococcus pneumoniae dihydropterolate synthase (sulA), dihydrofolate synthetase (sulB), guanosine triphosphate cyclohydrolase (sulC), aldolase-pyrophosphokinase (sulD) genes, complete cds	100	186	405
268	4	1793	1990	emb X63602 SP80	S.pneumoniae mmsA-Box	89	194	198
271	1	562	104	gb M29686	S.pneumoniae mismatch repair (hexB) gene, complete cds	93	160	459
291	1	75	524	gb U04047	Streptococcus pneumoniae SS2 dextran glucosidase gene and insertion sequence IS1202 transposase gene, complete cds	96	450	450
291	2	1001	525	emb 283335 SP28	S.pneumoniae dexB, capI(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and aIIA gene	87	205	477
291	3	807	559	emb 283335 SP28	S.pneumoniae dexB, capI(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and aIIA gene	90	170	249
291	4	1374	1099	gb M36180	Streptococcus pneumoniae transposase, (comA and comB) and SAICAR synthetase (purC) genes, complete cds	85	264	276

### TABLE I

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	percent ident	HSP nt length	ORF nt length
293	1	3	1673	emb Z67740 SPGY	S.pneumoniae gyrB gene and unknown orf	98	553	1671
296	1	1434	151	emb Z47210 SPDE	S.pneumoniae dexB, cap3A, cap3B and cap3C genes and orfs	99	430	1284
317	1	157	510	emb Z67739 SPPA	S.pneumoniae parC, parE and transposase genes and unknown orf	89	353	354
325	2	1237	485	emb Z83335 SPZ8	S.pneumoniae dexB, cap1(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and aIIA gene	91	299	753
326	1	1	462	emb Z82001 SPZ8	S.pneumoniae pcpA gene and open reading frames	100	233	462
327	1	603	64	emb Z83335 SPZ8	S.pneumoniae dexB, cap1(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and aIIA gene	94	89	540
334	1	153	545	gb U41735	Streptococcus pneumoniae peptide methionine sulfoxide reductase (msrA) and homoserine kinase homolog (thrB) genes, complete cds	87	91	393
336	1	308	93	emb Z26850 SPAT	S.pneumoniae (H222) genes for ATPase a subunit, ATPase b subunit and ATPase c subunit	97	102	216
360	1	1	519	emb Z67739 SPPA	S.pneumoniae parC, parE and transposase genes and unknown orf	95	435	519
360	4	1598	1960	emb Z83335 SPZ8	S.pneumoniae dexB, cap1(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and aIIA gene	94	353	363
362	1	673	2	emb Z83335 SPZ8	S.pneumoniae dexB, cap1(A,B,C,D,E,F,G,H,I,J,K) genes, dTDP-rhamnose biosynthesis genes and aIIA gene	95	63	672
362	2	1168	728	gb U04047	Streptococcus pneumoniae SS2 dextran glucosidase gene and insertion sequence IS1202 transposase gene, complete cds	96	441	441
384	1	347	111	emb X85787 SPCP	S.pneumoniae dexB, cps14A, cps14B, cps14C, cps14D, cps14E, cps14F, cps14G, cps14H, cps14I, cps14J, cps14K, cps14L, tsaA genes	94	54	237

TABLE 2  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
228	2	1760	1942	gi F60663 F606	translation elongation factor Tu - Streptococcus oralis	100	100	183
319	1	2	205	gi 984927	neomycin phosphotransferase [Cloning vector pBSL99]	100	100	204
260	1	2	1138	gi F60663 F606	translation elongation factor Tu - Streptococcus oralis	99	98	1137
25	2	486	1394	gi 1574495	hypothetical (Haemophilus influenzae)	98	96	909
94	2	685	1002	gi 310627	phosphoenolpyruvate:sugar phosphotransferase system HPr (Streptococcus mutans)	98	93	318
312	1	190	2	gi 347999	ATP-dependent protease proteolytic subunit (Streptococcus salivarius)	98	95	189
329	1	1	807	gi 924848	inosine monophosphate dehydrogenase (Streptococcus pyogenes)	98	94	807
336	2	290	589	gi 987050	lacZ gene product (unidentified cloning vector)	98	98	300
181	9	5948	7366	gi 153755	phospho-beta-D-galactosidase (EC 3.2.1.85) (Lactococcus lactis cremoris)	97	94	1419
312	2	1044	361	gi 347998	uracil phosphoribosyltransferase (Streptococcus salivarius)	97	88	684
32	8	6575	7486	sp P37214 ERA_S	GTP-BINDING PROTEIN ERA HOMOLOG	96	91	912
94	3	951	2741	gi 153615	phosphoenolpyruvate:sugar phosphotransferase system enzyme I (Streptococcus salivarius)	96	92	1791
127	1	1	168	gi 581299	initiation factor IF-1 (Lactococcus lactis)	96	89	168
128	14	10438	11154	gi 1276873	DeoD (Streptococcus thermophilus)	96	93	717
181	4	1362	1598	gi 46606	lacD polypeptide (AA 1-326) (Staphylococcus aureus)	96	80	237
218	1	1	834	gi 1743856	intragenic coaggregation-relevant adhesin (Streptococcus gordonii)	96	93	834
319	2	115	441	gi 208225	heat-shock protein 82/neomycin phosphotransferase fusion protein (hsp82-neo) (unidentified cloning vector)	96	96	327
54	12	8622	10967	gi PID d100972	Pyruvate formate-lyase (Streptococcus mutans)	95	89	2346
181	2	606	1289	gi 149396	lacD (Lactococcus lactis)	95	89	684
46	3	3410	3045	gi 1850606	YixM (Streptococcus mutans)	94	86	366
89	10	7972	7337	gi 703442	thymidine kinase (Streptococcus gordonii)	94	86	636
148	9	6431	7354	gi 995767	UDP-glucose pyrophosphorylase (Streptococcus pyogenes)	94	85	924
160	7	4430	5848	gi 153573	Hv ATPase (Enterococcus faecalis)	94	87	1419
2	3	4598	3513	gi 153763	plasmin receptor (Streptococcus pyogenes)	93	86	1086
12	8	7877	6204	gi 103865	formyl-tetrahydrofolate synthetase (Streptococcus mutans)	93	84	1674

**TABLE 2**  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
65	11	4734	5120	gi 40150	L14 protein (AA 1-122) [Bacillus subtilis]	93	87	387
68	1	53	1297	gi 47341	antitumor protein [Streptococcus pyogenes]	93	87	1245
80	1	3	299	gnl PID d101166	ribosomal protein S7 [Bacillus subtilis]	93	84	297
127	3	695	1093	gi 142462	ribosomal protein S11 [Bacillus subtilis]	93	86	399
160	5	1924	3462	gi 1773264	ATPase, alpha subunit [Streptococcus mutans]	93	85	1539
211	5	3757	3047	gi 535273	aminopeptidase C [Streptococcus thermophilus]	93	82	711
262	1	16	564	gi 149394	lacB [Lactococcus lactis]	93	90	549
366	1	197	3	gi 295259	tryptophan synthase beta subunit [Synecocystis sp.]	93	91	195
25	3	1392	1976	gi 1574496	hypothetical [Haemophilus influenzae]	92	80	585
36	21	20781	19927	gi 310632	hydrophobic membrane protein [Streptococcus gordonii]	92	86	855
181	3	1265	1534	gi 149396	lacD [Lactococcus lactis]	92	83	270
181	7	3662	4060	gi 149410	enzyme III [Lactococcus lactis]	92	83	399
32	4	5631	3937	gnl PID e294090	fibronectin-binding protein-like protein A [Streptococcus gordonii]	91	85	1695
46	2	3054	1462	gi 1850607	signal recognition particle Ffh [Streptococcus mutans]	91	84	1593
65	10	4442	4726	pir S17865 S178	ribosomal protein S17 - Bacillus stearothermophilus	91	80	285
77	2	260	1900	gi 287871	groEL gene product [Lactococcus lactis]	91	82	1641
84	1	2	2056	gi 871784	Cip-like ATP-dependent protease binding subunit [Bos taurus]	91	79	2055
99	8	10750	9272	gi 153740	sucrose phosphorylase [Streptococcus mutans]	91	84	1479
99	9	11947	11072	gi 153739	membrane protein [Streptococcus mutans]	91	78	876
127	5	2065	2469	pir S07223 R585	ribosomal protein L17 - Bacillus stearothermophilus	91	78	405
132	6	9539	9390	gi 143085	hubst [Bacillus stearothermophilus]	91	89	150
137	8	4765	6153	gnl PID d100347	Na <sup>+</sup> -ATPase beta subunit [Enterococcus hirae]	91	79	1389
151	7	11119	9734	gi 1815634	glutamine synthetase type 1 [Streptococcus agalactiae]	91	82	1386
201	2	1798	278	gi 2208998	dextran glucosidase Dxs [Streptococcus suis]	91	79	1521
222	2	673	1839	gi 153741	ATP-binding protein [Streptococcus mutans]	91	85	1167
293	5	4113	4400	gi 1196921	unknown protein [insertion sequence IS861]	91	71	288
32	7	6166	6570	pir A36933 A369	diacylglycerol kinase homolog - Streptococcus mutans	90	77	405

**TABLE 2**  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
33	2	841	527	gi 1196921	unknown protein (Insertion sequence IS861)	90	70	315
48	27	20908	19757	gnl PID e274705	lactate oxidase (Streptococcus iniae)	90	80	1152
55	21	13777	18515	gnl PID e221213	CIPX protein (Bacillus subtilis)	90	75	1263
56	2	717	977	gi 1710133	flagellar filament cap (Borrelia burgdorferi)	90	50	261
65	1	1	606	gi 1165303	L3 (Bacillus subtilis)	90	75	606
114	1	2	988	gi 153562	aspartate beta-semialdehyde dehydrogenase (EC 1.2.1.11) (Streptococcus mutans)	90	80	987
120	1	1345	827	gi 407880	ORF1 (Streptococcus equisimilis)	90	75	519
159	12	7690	8298	gi 143012	GMP synthetase (Bacillus subtilis)	90	84	609
166	4	4076	3282	gi 1661179	high affinity branched chain amino acid transport protein (Streptococcus mutans)	90	78	795
183	1	28	1395	gi 308858	ATP:pyruvate 2-O-phosphotransferase (Lactococcus lactis)	90	76	1368
191	3	2891	1662	gi 149521	tryptophan synthase beta subunit (Lactococcus lactis)	90	78	1230
198	2	1551	436	gi 2323342	(AF014460) CcpA (Streptococcus mutans)	90	76	1116
305	1	37	783	gi 1573551	asparagine synthetase A (anaA) (Haemophilus influenzae)	90	80	747
8	3	2285	3343	gi 149434	putative (Lactococcus lactis)	89	78	1059
46	8	7577	7362	pir A45434 A454	ribosomal protein L19 - Bacillus stearothermophilus	89	76	216
49	9	8363	10342	gi 153792	recP peptide (Streptococcus pneumoniae)	89	83	1980
51	14	18410	19447	gi 308857	ATP:D-fructose 6-phosphate 1-phosphotransferase (Lactococcus lactis)	89	81	1038
57	11	9686	10669	gnl PID d100932	H2O-forming NADH Oxidase (Streptococcus mutans)	89	77	984
65	5	2418	2786	gi 1165307	S19 (Bacillus subtilis)	89	81	369
65	8	3806	4225	sp P14577 RL16	S05 RIBOSOMAL PROTEIN L16	89	82	420
65	18	8219	8719	gi 143417	ribosomal protein S5 (Bacillus stearothermophilus)	89	76	501
73	9	6337	5315	gi 532204	prf (Listeria monocytogenes)	89	70	1023
76	3	3360	1465	gnl PID e200671	lepA gene product (Bacillus subtilis)	89	76	1896
99	10	12818	11919	gi 153738	membrane protein (Streptococcus mutans)	89	73	900
120	2	3552	1300	gi 407881	stringent response-like protein (Streptococcus equisimilis)	89	79	2253
122	5	4512	2791	gnl PID e280490	unknown (Streptococcus pneumoniae)	89	81	1722

TABLE 2

S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
176	1	669	4	gi147394	5-oxopropyl-peptidase (Streptococcus pyogenes)	89	78	666
177	6	3050	3934	gi1912423	putative (Lactococcus lactis)	89	71	885
181	8	4033	5751	gi149411	enzyme III (Lactococcus lactis)	89	80	1719
211	4	3149	2793	gi1535273	aminopeptidase C (Streptococcus thermophilus)	89	83	357
361	1	431	838	gi1196922	unknown protein (Insertion sequence IS861)	89	70	408
34	17	11839	10535	ep130053 SVH_S	HISTIDYL-TRNA SYNTHETASE (EC 6.1.1.21) (HISTIDINE-TRNA LIGASE) (HISRS)	88	78	1305
38	3	1646	2623	gi12058344	putative ABC transporter subunit ComYA (Streptococcus gordonii)	88	78	978
54	1	3	227	gn1 PID d101320	Yqgu (Bacillus subtilis)	88	66	225
57	2	611	1468	gn1 PID e134943	putative reductase I (Saccharomyces cerevisiae)	88	75	858
65	13	5497	6069	pir A29102 R58S	ribosomal protein L5 - Bacillus stearothermophilus	88	75	573
65	20	9030	9500	gi12078381	ribosomal protein L15 (Staphylococcus aureus)	88	83	471
78	3	3636	1108	gn1 PID d100781	lysyl-aminopeptidase (Lactococcus lactis)	88	80	2529
106	12	12965	12054	gi12407215	putative heat shock protein HspX (Streptococcus gordonii)	88	72	912
107	2	219	962	gn1 PID e339862	putative acylneuraminate lyase (Clostridium tertium)	88	75	744
111	8	14073	10420	gi1402363	RNA polymerase beta-subunit (Bacillus subtilis)	88	74	3654
126	9	13096	12062	gn1 PID e311468	unknown (Bacillus subtilis)	88	74	1035
140	17	19143	18874	gi11573659	H. influenzae predicted coding region HI0659 (Haemophilus influenzae)	88	61	270
144	1	394	555	gn1 PID e274705	lactate oxidase (Streptococcus infantis)	88	75	162
148	4	2723	3493	gi11591672	phosphate transport system ATP-binding protein (Methanococcus jannaschii)	88	68	771
160	8	5853	6278	gi11773267	ATPase, epsilon subunit (Streptococcus mutans)	88	65	426
177	4	1770	2885	gi1149426	putative (Lactococcus lactis)	88	72	1116
211	6	4140	3613	gi1535273	aminopeptidase C (Streptococcus thermophilus)	88	74	528
231	4	580	957	gi140186	homologous to E.coli ribosomal protein L27 (Bacillus subtilis)	88	78	378
260	5	2387	2998	gi11196922	unknown protein (Insertion sequence IS861)	88	69	612
291	6	2017	3375	gn1 PID d100571	adenylosuccinate synthetase (Bacillus subtilis)	88	75	1359
319	4	658	317	gi1603578	serine/threonine kinase (Phytophthora capsici)	88	88	342
40	5	4353	4514	gi1153672	lactose repressor (Streptococcus mutans)	87	56	162



TABLE 2

S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
49	10	10660	10929	gi1196921	unknown protein [insertion sequence IS861]	87	72	270
65	7	3140	3808	gi1165309	S3 [Bacillus subtilis]	87	73	669
65	15	6623	7039	gi1044978	ribosomal protein S8 [Bacillus subtilis]	87	73	417
75	8	5411	6625	gi11877422	galactokinase [Streptococcus mutans]	87	78	1215
80	2	703	2805	gnlPID d101166	elongation factor G [Bacillus subtilis]	87	76	2103
82	1	541	248	gi1196921	unknown protein [insertion sequence IS861]	87	69	294
140	23	25033	23897	gnlPID e254999	phenylalanyl-tRNA synthetase beta subunit [Bacillus subtilis]	87	74	1137
214	14	10441	8516	gi12281305	glucose inhibited division protein homolog Gida [Lactococcus lactis cremoris]	87	75	1926
220	2	2742	874	gnlPID e124358	product highly similar to elongation factor EF-G [Bacillus subtilis]	87	73	1869
260	4	2096	2389	gi1196921	unknown protein [insertion sequence IS861]	87	72	294
323	1	27	650	gi1897795	30S ribosomal protein [Pedococcus acidilactici]	87	73	624
357	1	154	570	gi1044978	ribosomal protein S8 [Bacillus subtilis]	87	73	417
49	11	10927	11445	gi1196922	unknown protein [insertion sequence IS861]	86	63	519
59	12	7461	9224	gi1951051	relaxase [Streptococcus pneumoniae]	86	68	1764
65	4	1553	2401	pir A02759 R5BS	ribosomal protein L2 - Bacillus stearothermophilus	86	77	849
65	23	10957	11610	gi144074	adenylate kinase [Lactococcus lactis]	86	76	654
82	4	4374	4856	gi1153745	mannitol-specific enzyme III [Streptococcus mutans]	86	72	483
102	4	4270	4986	gnlPID e264705	OMP decarboxylase [Lactococcus lactis]	86	76	717
106	6	7824	6880	gnlPID e137598	aspartate transcarbamylase [Lactobacillus leichmannii]	86	68	945
107	1	1	273	gnlPID e339862	putative acylneuraminate lyase [Clostridium tertium]	86	71	273
111	7	10432	6710	gnlPID e228283	DNA-dependent RNA polymerase [Streptococcus pyogenes]	86	80	3723
131	9	5704	4892	gi11661193	polipoprotein diacylglycerol transferase [Streptococcus mutans]	86	71	813
134	7	6430	7980	gi12388637	glycerol kinase [Enterococcus faecalis]	86	73	1551
146	11	7473	6583	gi11591731	melvalonate kinase [Methanococcus jannaschii]	86	72	891
153	2	595	2010	gi12160707	dipeptidase [Lactococcus lactis]	86	78	1416
154	1	2	1435	gi11857246	6-phosphogluconate dehydrogenase [Lactococcus lactis]	86	74	1434

TABLE 2

S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
161	5	5025	6284	gi 47529	Unknown (Streptococcus salivarius)	86	66	1260
184	1	2	1483	gi 642667	NADP-dependent glyceraldehyde-3-phosphate dehydrogenase (Streptococcus mutans)	86	73	1482
210	8	3659	6571	gi 153661	translational initiation factor IF2 (Enterococcus faecium)	86	76	2913
250	1	2	187	gi 1573551	asparagine synthetase A (asnA) (Haemophilus influenzae)	86	68	186
36	4	2644	3909	gi 2149909	cell division protein (Enterococcus faecalis)	85	73	1266
38	4	2475	3587	gi 2058545	putative ABC transporter subunit ComYB (Streptococcus gordonii)	85	72	1113
38	5	3577	3915	gi 2058546	ComYC (Streptococcus gordonii)	85	80	339
57	5	2797	3789	gnl PID d101316	Yqj3 (Bacillus subtilis)	85	72	993
82	5	4915	6054	gi 153746	mannitol-phosphate dehydrogenase (Streptococcus mutans)	85	68	1140
83	15	14690	15793	gi 143371	phosphoribosyl aminimidazole synthetase (PUR-M) (Bacillus subtilis)	85	69	1104
87	2	1417	2388	gi 1184967	ScrR (Streptococcus mutans)	85	69	972
108	3	2666	3154	gi 153566	ORF (19K protein) (Enterococcus faecalis)	85	67	489
127	2	312	692	gi 1044989	ribosomal protein S13 (Bacillus subtilis)	85	72	381
128	3	1534	2409	gi 1685110	tetrahydrofolate dehydrogenase/cyclohydrolase (Streptococcus thermophilus)	85	71	876
137	7	2962	4767	gnl PID d100347	Na <sup>+</sup> -ATPase alpha subunit (Enterococcus hirae)	85	74	1806
170	2	2622	709	gnl PID d102006	(AB001488) FUNCTION UNKNOWN, SIMILAR PRODUCT IN E. COLI, M. INFLUENZAE AND NEISSERIA MENINGITIDIS. (Bacillus subtilis)	85	70	1914
187	5	3760	4386	gi 727436	putative 20-kDa protein (Lactococcus lactis)	85	65	627
233	2	728	1873	gi 1163116	ORF-5 (Streptococcus pneumoniae)	85	67	1146
234	3	962	1255	gi 2293155	(AF008220) YtiA (Bacillus subtilis)	85	61	294
240	1	309	1931	gi 143597	CTP synthetase (Bacillus subtilis)	85	70	1623
6	1	199	1521	gi 508979	GTP-binding protein (Bacillus subtilis)	84	72	1323
10	4	4375	3443	gnl PID d139862	putative acylneuraminate lyase (Clostridium tertium)	84	70	933
14	1	63	2093	gi 520753	DNA topoisomerase I (Bacillus subtilis)	84	69	2031
19	4	1793	2593	gi 2352484	(AF005098) RNaseH II (Lactococcus lactis)	84	68	801
20	17	17720	19687	gnl PID d100584	cell division protein (Bacillus subtilis)	84	71	1968
22	28	21723	20884	gi 299163	alanine dehydrogenase (Bacillus subtilis)	84	68	840

TABLE 2

S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
30	10	7730	6792	gi PID d100296	fructokinase [Streptococcus mutans]	84	75	939
33	9	5650	5300	gi 147194	phnA protein [Escherichia coli]	84	71	351
36	22	21551	20772	gi 310631	ATP binding protein [Streptococcus gordonii]	84	72	780
48	4	2837	2505	gi 882609	6-phospho-beta-glucosidase [Escherichia coli]	84	69	333
58	1	41	1516	gi 450849	amylase [Streptococcus bovis]	84	73	1476
59	10	6715	7116	gi 1951053	ORF10, putative [Streptococcus pneumoniae]	84	74	402
62	1	21	644	gi 806487	ORF211, putative [Lactococcus lactis]	84	66	624
65	17	7779	8207	gi 1044980	ribosomal protein L18 [Bacillus subtilis]	84	73	429
65	21	9507	10397	gi 44073	SecY protein [Lactococcus lactis]	84	68	891
106	4	5474	2262	gi PID e199387	carbamoyl-phosphate synthase [Lactobacillus plantarum]	84	73	3213
159	1	147	4	gi 806487	ORF211, putative [Lactococcus lactis]	84	63	144
163	4	4690	5910	gi 2293164	[AF008220] SAM synthase [Bacillus subtilis]	84	69	1221
192	1	46	1308	gi 495046	tripeptidase [Lactococcus lactis]	84	73	1263
348	1	671	6	gi 1787753	[AE000245] f346, 79 pct identical to 336 amino acids of ADH1-2YHMO SW: P20368 but has 10 additional N-ter residues [Escherichia coli]	84	71	666
3	4	1572	3575	gi 143766	[thrsv] (EC 6.1.1.3) [Bacillus subtilis]	83	65	2004
9	6	3893	3417	gi PID d100576	single strand DNA binding protein [Bacillus subtilis]	83	68	477
17	15	7426	8457	gi 520738	comA protein [Streptococcus pneumoniae]	83	66	1032
20	12	13860	14144	gi PID d100583	unknown [Bacillus subtilis]	83	61	285
23	4	3358	2606	gi 1788294	[AE000290] o238; This 238 aa orf is 40 pct identical (5 gaps) to 231 residues of an approx. 248 aa protein YB8C_ECOLI SW: P24237 [Escherichia coli]	83	74	753
28	6	3304	3005	gi 1573659	H. influenzae predicted coding region H10659 [Haemophilus influenzae]	83	57	300
35	7	5108	3867	gi 311707	hypothetical nucleotide binding protein [Acholeplasma laidlawii]	83	63	1242
55	19	17932	17528	gi 537085	ORF_141 [Escherichia coli]	83	59	405
55	20	18539	17919	gi 496558	orfX [Bacillus subtilis]	83	69	621
65	6	2795	3142	gi 1165308	L22 [Bacillus subtilis]	83	64	348
68	6	6877	6883	gi 1213494	immunoglobulin A1 protease [Streptococcus pneumoniae]	83	54	195

TABLE 2

S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
87	15	15112	14771	gnl pid e323522	putative rpoZ protein (Bacillus subtilis)	83	54	342
96	12	8963	9631	gi 47394	5-oxopropyl-peptidase (Streptococcus pyogenes)	83	73	669
98	1	3	263	gi 183885	glutamine-binding subunit (Bacillus subtilis)	83	55	261
120	4	7170	5233	gi 310630	zinc metalloprotease (Streptococcus gordonii)	83	72	1938
127	7	2998	4347	gi 1500567	M. jannaschii predicted coding region MJ1665 [Methanococcus jannaschii]	83	72	1350
137	1	3	440	gi 472918	v-type Na-ATPase (Enterococcus hirae)	83	60	438
160	6	3466	4356	gi 1773265	ATPase, gamma subunit (Streptococcus mutans)	83	67	891
214	4	2278	2964	gi 663279	transposase (Streptococcus pneumoniae)	83	72	687
226	3	2367	2020	gi 142154	thioredoxin (Synecococcus PCC6301)	83	58	348
303	1	3	1049	gi 40046	phosphoglucose isomerase A (AA 1-449) (Bacillus stearothermophilus)	83	67	1047
303	2	1155	1931	gi 289282	glutamyI-tRNA synthetase (Bacillus subtilis)	83	67	777
6	17	15370	14318	gi 633147	ribose-phosphate pyrophosphokinase (Bacillus caldolyticus)	82	64	1053
7	1	299	96	gi 143648	ribosomal protein L28 (Bacillus subtilis)	82	69	204
9	3	1479	1090	gi 385178	unknown (Bacillus subtilis)	82	46	390
9	7	4213	3899	gnl pid d100576	ribosomal protein S6 (Bacillus subtilis)	82	60	315
12	6	4688	3942	gnl pid d100571	unknown (Bacillus subtilis)	82	68	747
22	17	13422	14837	gi 520754	putative (Bacillus subtilis)	82	69	1416
22	18	14897	15658	gnl pid d101929	uridine monophosphate kinase (Synecocystis sp.)	82	62	762
33	16	11471	10641	gnl pid d101190	ORF4 (Streptococcus mutans)	82	68	831
35	9	7400	6255	gi 1881543	UDP-N-acetylglucosamine-2-epimerase (Streptococcus pneumoniae)	82	68	1146
40	10	8003	7533	gi 1173519	riboflavin synthase beta subunit (Actinobacillus pleuropneumoniae)	82	68	471
48	32	23159	23437	gi 1930092	outer membrane protein (Campylobacter jejuni)	82	61	279
52	14	13833	14765	gi 142521	deoxyribodipyrimidine photolyase (Bacillus subtilis)	82	61	933
60	4	4737	1849	gnl pid d102221	(AB001610) uvrA (Deinococcus radiodurans)	82	66	2889
62	4	2131	1457	gi 2246749	(AF009622) thioredoxin reductase (Listeria monocytogenes)	82	63	675
71	11	16586	17518	gnl pid e322063	ss-1,4-galactosyltransferase (Streptococcus pneumoniae)	82	60	933
73	13	9222	7837	gnl pid d100586	unknown (Bacillus subtilis)	82	65	1386

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S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
74	1	1	3771	gml PID d101199	alkaline amylopullulanase (Bacillus sp.)	82	68	3771
83	9	1696	3983	gml PID e305362	unnamed protein product (Streptococcus thermophilus)	82	52	288
86	11	10776	9394	gml 693583	5-enolpyruvylshikimate-3-phosphate synthase (Lactococcus lactis)	82	67	1383
89	12	8295	9752	gml 40025	homologous to E. coli 50K (Bacillus subtilis)	82	66	1458
115	9	10347	8812	gml PID d102090	(AB003927) phospho-beta-galactosidase 1 (Lactobacillus gasserii)	82	74	1536
118	1	1	1332	gml PID d100579	seryl-tRNA synthetase (Bacillus subtilis)	82	71	1332
151	3	4657	6246	pir S06097 S060	type I site-specific deoxyribonuclease (EC 3.1.21.3) CfrA chain S - Citrobacter freundii	82	66	1590
173	6	4183	3503	gml 2313836	(AE000584) conserved hypothetical protein (Helicobacter pylori)	82	68	681
177	12	5481	7442	gml PID d101999	(AB001341) NcrB (Escherichia coli)	82	58	1962
193	2	178	576	pir S08564 R385	ribosomal protein S9 - Bacillus stearothermophilus	82	70	399
245	2	258	845	gml 146402	EcoA type I restriction-modification enzyme 8 subunit (Escherichia coli)	82	68	588
9	5	3400	3146	gml PID d100576	ribosomal protein S18 (Bacillus subtilis)	81	66	255
16	7	7484	8413	gml 1100074	tryptophanyl-tRNA synthetase (Clostridium longisporum)	81	70	930
20	11	10308	13820	gml PID d100583	transcription-repair coupling factor (Bacillus subtilis)	81	63	3513
38	2	1232	1606	gml 2058543	putative DNA binding protein (Streptococcus gordonii)	81	63	375
45	2	3061	1751	gml 460259	enolase (Bacillus subtilis)	81	67	1311
46	1	2	1267	gml 431231	uracil permease (Bacillus caldolyticus)	81	61	1266
48	3	2453	1440	gml PID d100453	Mannosephosphate isomerase (Streptococcus mutans)	81	70	1014
54	2	1106	336	gml 154752	transport protein (Agrobacterium tumefaciens)	81	64	771
65	22	10306	10821	gml 44073	SecY protein (Lactococcus lactis)	81	66	516
89	4	3874	2603	gml 556886	serine hydroxymethyltransferase (Bacillus subtilis)	81	69	1272
99	16	19126	18929	gml 2313526	(AE000557) H. pylori predicted coding region HP0411 (Helicobacter pylori)	81	75	198
106	7	8373	7822	gml PID e199384	pyr (Lactobacillus plantarum)	81	61	552
108	6	5054	6877	gml 1469939	group B oligopeptidase PepB (Streptococcus agalactiae)	81	66	1824
113	15	15899	18283	pir S09411 S094	spoIIIE protein - Bacillus subtilis	81	65	2385
128	5	3359	3634	gml 1685111	orf1091 (Streptococcus thermophilus)	81	69	276

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S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
151	1	830	3211	gi 304896	EcoE type I restriction-modification enzyme R subunit [Escherichia coli]	81	59	2382
159	11	6722	7837	gi 2239288	GMP synthetase [Bacillus subtilis]	81	69	1116
170	1	739	458	gnl PID102006	(AB001488) FUNCTION UNKNOWN. [Bacillus subtilis]	81	55	282
191	2	1759	893	gi 149532	tryptophan synthase alpha subunit [Lactococcus lactis]	81	65	867
214	3	2290	1994	gi 157587	reverse transcriptase endonuclease [Drosophila virilis]	81	43	297
217	4	4415	4008	gi 466473	cellulose phosphorylase enzyme II' [Bacillus stearothermophilus]	81	59	408
262	2	569	868	gi 153675	tagatose 6-P kinase [Streptococcus mutans]	81	68	300
299	1	663	4	gnl PID301154	StySKI methylase [Salmonella enterica]	81	60	660
366	2	376	83	gi 149521	tryptophan synthase beta subunit [Lactococcus lactis]	81	65	294
12	10	8766	9242	gi 1216490	DNA/pantothenate metabolism flavoprotein [Streptococcus mutans]	80	64	477
17	11	6050	5748	gnl PID305362	unnamed protein product [Streptococcus thermophilus]	80	67	303
17	16	8455	9066	gi 703126	leucocin A translocator [Leuconostoc gelidium]	80	59	612
18	3	2440	1613	gi 1591672	phosphate transport system ATP-binding protein [Methanococcus jannaschii]	80	58	828
27	3	4248	1579	gi 452309	valyl-tRNA synthetase [Bacillus subtilis]	80	69	2670
28	7	3671	3288	gi 1573660	H. influenzae predicted coding region H10680 [Haemophilus influenzae]	80	63	384
32	2	902	1933	gnl PID264499	dihydroxylate dehydrogenase B [Lactococcus lactis]	80	66	1032
39	1	1	1266	gnl PID234078	hom [Lactococcus lactis]	80	63	1266
52	5	4363	3593	gi 1183684	ATP-binding subunit [Bacillus subtilis]	80	57	771
54	5	4550	4744	gi 2198820	(AF004225) Cux/CDP homeoprotein [Mus musculus]	80	60	195
59	11	7109	7486	gi 931052	ORF9, putative [Streptococcus pneumoniae]	80	68	378
65	3	1230	1550	pir A02815 R585	ribosomal protein L23 - Bacillus stearothermophilus	80	69	321
65	12	5174	5503	pir A02819 R585	ribosomal protein L24 - Bacillus stearothermophilus	80	70	330
66	9	9884	10687	gi 2313836	(AE000384) conserved hypothetical protein [Helicobacter pylori]	80	66	804
82	2	648	2438	gi 622391	mamitol transport protein [Bacillus stearothermophilus]	80	65	1791
85	1	950	630	gi 528995	polyketide synthase [Bacillus subtilis]	80	46	321
89	8	6870	5779	gi 853776	peptide chain release factor 1 [Bacillus subtilis]	80	63	1092
93	12	8718	7438	gnl PID101959	hypothetical protein [Synecocystis sp.]	80	60	1281

TABLE 2

S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
106	5	6854	5751	gnl pid e199386	glutaminase of carbanoyl-phosphate synthase [Lactobacillus plantarum]	80	65	1104
109	2	2160	1450	gi 40056	phoP gene product [Bacillus subtilis]	80	59	711
124	9	4246	3953	gnl pid d102254	30S ribosomal protein S16 [Bacillus subtilis]	80	65	294
128	8	5148	6428	gi 2281308	phosphopentomutase [Lactococcus lactis cremoris]	80	66	1281
137	19	12665	11376	gi 159109	NADP-dependent glutamate dehydrogenase [Giardia intestinalis]	80	68	1290
140	19	19699	19457	gi 517210	putative transposase [Streptococcus pyogenes]	80	70	243
158	2	2474	984	gi 1877423	galactose-1-P-uridylyl transferase [Streptococcus mutans]	80	65	1491
171	10	7474	7728	gi 397800	cyclophilin C-associated protein [Mus musculus]	80	60	255
181	1	2	619	gi 149395	lacC [Lactococcus lactis]	80	66	618
313	1	27	539	gi 143467	ribosomal protein S4 [Bacillus subtilis]	80	70	513
329	2	1652	858	gi 533080	RacF protein [Streptococcus pyogenes]	80	63	795
371	1	2	958	gi 442360	ClpC adenosine triphosphatase [Bacillus subtilis]	80	58	957
8	7	4312	5580	gi 149435	putative [Lactococcus lactis]	79	64	1269
23	1	1175	135	gi 1542975	AbcB [Thermanserobacterium thermosulfurigenes]	79	61	1041
33	14	9244	8201	gnl pid e253891	UDP-glucose 4-epimerase [Bacillus subtilis]	79	62	1044
36	3	1242	2633	gnl pid e324218	ftsA [Enterococcus hirae]	79	58	1392
38	13	7155	8378	gi 405134	acetate kinase [Bacillus subtilis]	79	58	1224
55	7	9011	8229	gi 1146234	dihydrodipicolinate reductase [Bacillus subtilis]	79	56	783
65	19	8661	8915	gi 2078380	ribosomal protein L30 [Staphylococcus aureus]	79	68	255
69	4	3678	2128	gnl pid e311452	unknown [Bacillus subtilis]	79	64	1551
69	9	7881	7279	gi 677850	hypothetical protein [Staphylococcus aureus]	79	59	603
72	10	8491	9783	gnl pid d101091	hypothetical protein [Synecocystis sp.]	79	62	1293
80	3	2906	7300	gi 143342	polymerase III [Bacillus subtilis]	79	65	4395
82	14	13326	15689	gnl pid e255093	hypothetical protein [Bacillus subtilis]	79	65	2364
86	13	12233	11118	gi 683582	prephenate dehydrogenase [Lactococcus lactis]	79	58	1116
92	3	940	1734	gi 537286	triosephosphate isomerase [Lactococcus lactis]	79	65	795
98	6	4023	4742	gnl pid d100262	livG protein [Salmonella typhimurium]	79	63	720

TABLE 2

S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
99	12	16315	14150	gi 153736	a-galactosidase (Streptococcus mutans)	79	64	2166
107	7	5684	6406	gi 460080	D-alanine:D-alanine ligase-related protein (Enterococcus faecalis)	79	58	723
113	9	6858	8303	gi 466882	ppp1; B1496_C2_189 (Mycobacterium leprae)	79	64	1446
151	10	13424	12213	gi 450686	3-phosphoglycerate kinase (Thermotoga maritima)	79	60	1212
162	2	1158	3017	gi 506700	CapD (Staphylococcus aureus)	79	67	1860
177	5	2876	3052	gi 912423	putative (Lactococcus lactis)	79	61	177
177	8	4198	4563	gi 149429	putative (Lactococcus lactis)	79	61	366
187	3	2728	2907	gnl pid d102002	(AB001488) FUNCTION UNKNOWN. (Bacillus subtilis)	79	53	180
189	7	3589	4350	gnl pid e183449	putative ATP-binding protein of ABC-type (Bacillus subtilis)	79	61	762
191	5	4249	3449	gi 149519	indoleglycerol phosphate synthase (Lactococcus lactis)	79	66	801
211	3	1805	2737	gi 147404	mannose permease subunit II-M-Man (Escherichia coli)	79	57	933
212	3	3863	3621	gnl pid e209004	glutaredoxin-like protein (Lactococcus lactis)	79	58	243
215	1	987	715	gi 2293242	(AF008220) arginine succinate synthase (Bacillus subtilis)	79	64	273
323	2	530	781	gi 897795	30S ribosomal protein (Pediococcus acidilactici)	79	67	252
380	1	694	2	gi 1184680	polynucleotide phosphorylase (Bacillus subtilis)	79	64	693
384	2	655	239	gi 143328	phoP protein (put.); putative (Bacillus subtilis)	79	59	417
6	3	2820	4091	gi 853767	UDP-N-acetylglucosamine 1-carboxyvinyltransferase (Bacillus subtilis)	78	62	1272
8	1	50	1786	gi 149432	putative (Lactococcus lactis)	78	63	1737
9	1	351	124	gi 897793	y98 gene product (Pediococcus acidilactici)	78	59	228
15	8	7364	8314	gnl pid d100585	cysteine synthetase A (Bacillus subtilis)	78	63	951
20	10	9738	10310	gnl pid d100583	stage V sporulation (Bacillus subtilis)	78	58	573
20	16	17165	17713	gi 49105	hypoxanthine phosphoribosyltransferase (Lactococcus lactis)	78	59	549
22	22	17388	18416	gnl pid d101315	yqfE (Bacillus subtilis)	78	60	1029
22	27	20971	20612	gi 299163	alanine dehydrogenase (Bacillus subtilis)	78	59	360
34	8	7407	7105	gi 41015	aspartate-tRNA ligase (Escherichia coli)	78	55	303
35	8	6257	5196	gi 1657644	Cap8E (Staphylococcus aureus)	78	60	1052



TABLE 2

S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
40	11	9287	8001	gi 1173518	GTP cyclohydrolase II/ 3,4-dihydroxy-2-butanone-4-phosphate synthase [Actinobacillus pleuropneumoniae]	78	58	1287
48	31	22422	23183	gi 2314330	[AE000623] glutamine ABC transporter, ATP-binding protein (glnQ) [Helicobacter pylori]	78	58	762
52	2	2101	1430	gi 1183887	Integral membrane protein [Bacillus subtilis]	78	54	672
55	14	13605	12712	gnl PID d102026	[AB00150] YbbP [Bacillus subtilis]	78	58	894
55	17	16637	15612	gnl PID e313027	hypothetical protein [Bacillus subtilis]	78	51	1026
71	14	19756	19598	gi 179764	calcium channel alpha-1D subunit [Homo sapiens]	78	57	159
74	11	15031	14018	gi 1573279	Holliday junction DNA helicase (ruvB) [Haemophilus influenzae]	78	57	1014
75	9	6623	7972	gi 1877423	galactose-1-P-uridyl transferase [Streptococcus mutans]	78	62	1350
81	12	12125	13906	gi 1573607	L-fucose isomerase (fucI) [Haemophilus influenzae]	78	66	1782
82	3	2423	4417	gi 153744	ORF X; putative [Streptococcus mutans]	78	64	1995
83	18	16926	18500	gi 143373	phosphoribosyl aminoimidazole carboxy formyl formyltransferase/inosine monophosphate cyclohydrolase (PUR-H(J)) [Bacillus subtilis]	78	63	1575
83	20	20212	20775	gi 143364	phosphoribosyl aminoimidazole carboxylase I (PUR-E) [Bacillus subtilis]	78	64	564
92	2	165	878	gnl PID d101190	ORF2 [Streptococcus mutans]	78	62	714
98	8	5863	6909	gi 2331287	[AF013188] release factor 2 [Bacillus subtilis]	78	63	1047
113	3	1071	2741	gi 580914	[dnaX [Bacillus subtilis]	78	64	1671
127	4	1133	2071	gi 142463	RNA polymerase alpha-core subunit [Bacillus subtilis]	78	59	939
132	1	2782	497	gi 1561763	[pullulanase [Bacteroides thetaiotaomicron]	78	58	2286
135	4	2698	3337	gi 1788036	[AE000269] NH3-dependent NAD synthetase [Escherichia coli]	78	66	840
140	24	26853	25423	gi 1100077	phospho-beta-glucosidase [Clostridium longisporum]	78	64	1431
150	5	4690	4514	gi 149464	amino peptidase [Lactococcus lactis]	78	42	177
152	1	1	795	gi 639915	[NADH dehydrogenase subunit (Thunbergia alata]	78	43	795
162	4	4997	4110	gnl PID e323528	[putative YhaP protein [Bacillus subtilis]	78	64	888
181	10	8651	7947	gi 149402	[lactose repressor (lacR; alt.) [Lactococcus lactis]	78	48	705
200	4	3627	4958	gnl PID d100172	[invertase [Zymomonas mobilis]	78	61	1332
203	3	3230	3015	gi 1174237	Cyck [Pseudomonas fluorescens]	78	57	216

**TABLE 2**  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
210	9	6789	7172	gi1580902	ORF6 gene product [Bacillus subtilis]	78	42	384
214	6	3810	2797	gnl PID d102049	P. haemolytica o-sialoglycoprotein endopeptidase; P36175 (660) transmembrane [Bacillus subtilis]	78	60	1014
214	13	6322	8163	gi1377831	unknown [Bacillus subtilis]	78	62	1842
217	1	9	2717	gi1488430	alcohol dehydrogenase 2 [Entamoeba histolytica]	78	64	2709
222	3	2316	3098	gi1573047	spore germination and vegetative growth protein (gerC2) [Haemophilus influenzae]	78	65	783
268	1	742	8	gi1517210	putative transposase [Streptococcus pyogenes]	78	65	735
276	1	223	733	gnl PID d100306	ribosomal protein L1 [Bacillus subtilis]	78	65	531
312	3	1567	1079	gi1289261	comE ORF2 [Bacillus subtilis]	78	54	489
339	1	117	794	gi1916729	CadD [Staphylococcus aureus]	78	53	678
342	2	762	265	gi1842439	phosphatidylglycerophosphate synthase [Bacillus subtilis]	78	59	498
383	1	737	3	gi1184680	polynucleotide phosphorylase [Bacillus subtilis]	78	64	735
7	15	11923	11018	gi1139855	carboxyltransferase beta subunit [Synechococcus PCC7942]	77	63	906
8	2	1698	2255	gi1149433	putative [Lactococcus lactis]	77	59	558
17	14	6948	7550	gi1520738	comA protein [Streptococcus pneumoniae]	77	60	603
30	12	9761	8967	gi1300451	TreP [Bacillus subtilis]	77	43	795
36	14	11421	12131	gi1573766	phosphoglyceromutase (gpmA) [Haemophilus influenzae]	77	64	711
55	3	3836	4096	gi1708640	YeaB [Bacillus subtilis]	77	55	261
61	8	8377	8054	gi1890649	multidrug resistance protein LmrA [Lactococcus lactis]	77	51	324
65	2	607	1254	gi140103	ribosomal protein L4 [Bacillus stearothermophilus]	77	63	648
68	8	7509	7240	gi147551	MRP [Streptococcus suis]	77	68	270
69	1	1083	118	gnl PID a311493	unknown [Bacillus subtilis]	77	57	566
77	5	4583	4026	gnl PID a281578	hypothetical 12.2 kd protein [Bacillus subtilis]	77	60	558
83	14	13104	14552	gi1590947	amidophosphoribosyltransferase [Methanococcus jannaschii]	77	56	1449
94	4	3006	5444	gnl PID a329895	(A3000496) cyclic nucleotide-gated channel beta subunit [Rattus norvegicus]	77	66	2439
96	11	8518	8880	gi1551879	ORF 1 [Lactococcus lactis]	77	62	363
99	11	14082	12799	gi153737	sugar-binding protein [Streptococcus mutans]	77	61	1284

**TABLE 2**  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
106	2	361	1176	gi 148921	LicD protein (Haemophilus influenzae)	77	51	816
108	4	3152	4030	gi 1574730	cellulose resistance protein (tebB) (Haemophilus influenzae)	77	58	879
118	4	3520	3131	gi 1573900	D-alanine permease (dagA) (Haemophilus influenzae)	77	57	390
124	4	1796	1071	gi 1573162	tRNA (guanine-N1)-methyltransferase (trmB) (Haemophilus influenzae)	77	58	726
126	4	5909	4614	gnl PID d101163	Srb (Bacillus subtilis)	77	62	1296
128	2	630	1373	gnl PID d101328	Yq12 (Bacillus subtilis)	77	58	744
130	1	1	1287	gnl PID e325013	hypothetical protein (Bacillus subtilis)	77	61	1287
139	5	4388	3639	gi 2293302	(AF008220) YtaA (Bacillus subtilis)	77	59	750
140	11	10931	9582	gi 289284	cysteinyI-tRNA synthetase (Bacillus subtilis)	77	64	1350
140	18	19451	19263	gi 517210	putative transposase (Streptococcus pyogenes)	77	66	189
141	2	976	1683	gnl PID e157887	URF5 (aa 1-573) (Drosophila yakuba)	77	50	708
141	4	2735	5293	gi 556258	secA (Listeria monocytogenes)	77	59	2559
144	2	671	2173	gnl PID d100585	lysyl-tRNA thynthetase (Bacillus subtilis)	77	61	1503
163	5	6412	7398	gi 511015	dihydroorotate dehydrogenase A (Lactococcus lactis)	77	62	987
164	10	7841	7074	gnl PID d100964	homologue of iron dicitrate transport ATP-binding protein PecE of E. coli (Bacillus subtilis)	77	52	768
191	8	7257	5791	gi 149516	anthranilate synthase alpha subunit (Lactococcus lactis)	77	57	1467
198	8	5377	5177	gi 1573856	hypothetical (Haemophilus influenzae)	77	66	201
213	1	202	462	gi 1743860	Bica2 (Mus musculus)	77	50	261
250	2	231	509	gnl PID e334776	Y1bH protein (Bacillus subtilis)	77	60	279
289	3	1737	1276	gnl PID d100947	Ribosomal Protein L10 (Bacillus subtilis)	77	62	462
292	2	1399	668	gi 143004	transfer RNA-Gln synthetase (Bacillus stearothermophilus)	77	58	732
7	3	2734	1166	gnl PID d101824	peptide-chain-release factor 3 (Synecocystis sp.)	76	53	1569
7	23	18474	18235	gi 455157	acyl carrier protein (Cryptomonas phi)	76	57	240
9	8	5706	4342	gi 1146247	asparaginyl-tRNA synthetase (Bacillus subtilis)	76	61	1365
10	5	4531	4385	gnl PID e314495	hypothetical protein (Clostridium perfringens)	76	53	147
18	2	1615	842	gi 1591672	phosphate transport system ATP-binding protein (Methanococcus jannaschii)	76	56	774

TABLE 2

S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
22	37	27796	28173	gnl PID e13389	translation initiation factor IF3 (AA 1-172) (Bacillus stearothermophilus)	76	64	378
35	6	3869	2682	gi 1773346	CapSG (Staphylococcus aureus)	76	61	1188
48	28	21113	21787	gi 2314328	[AE000023] glutamine ABC transporter, permease protein (glnP) (Helicobacter pylori)	76	52	675
52	12	12881	13786	gi 142521	[deoxyribodipyrimidine photolyase (Bacillus subtilis)]	76	58	906
55	10	11521	10571	gnl PID e283110	[femD (Staphylococcus aureus)]	76	61	951
57	8	7824	6559	gi 290561	[ol88 (Escherichia coli)]	76	47	1266
62	5	2406	2095	gnl PID e313024	[hypothetical protein (Bacillus subtilis)]	76	59	312
65	9	4223	4441	gi 40148	[L29 protein (AA 1-66) (Bacillus subtilis)]	76	58	219
68	2	1328	2371	gnl PID e284233	[anabolic ornithine carbamoyltransferase (Lactobacillus plantarum)]	76	61	1044
69	8	7297	6005	gnl PID d101420	[Pyrimidine nucleoside phosphorylase (Bacillus stearothermophilus)]	76	61	1293
73	12	7839	7267	gnl PID e243629	[unknown (Mycobacterium tuberculosis)]	76	53	573
74	5	8433	7039	gnl PID d102048	[C. thermocellum beta-glucosidase; P26208 1985] (Bacillus subtilis)	76	60	1395
80	5	7643	7936	gi 2314030	[AE000599] conserved hypothetical protein (Helicobacter pylori)	76	61	294
82	15	16019	16996	gi 1573900	[D-alanine permease (dapA) (Haemophilus influenzae)]	76	56	978
83	19	18616	19884	gi 143374	[phosphoribosyl glycine synthetase (PUR-D; gtg start codon) (Bacillus subtilis)]	76	60	1269
86	14	13409	12231	gi 143606	[AroF (Bacillus subtilis)]	76	58	1179
87	1	3	1442	gi 153804	[sucrose-6-phosphate hydrolase (Streptococcus mutans)]	76	59	1440
87	16	15754	15110	gnl PID e23500	[putative Gmk protein (Bacillus subtilis)]	76	56	645
93	4	1769	1539	gi 1574820	[1,4-alpha-glucan branching enzyme (glgB) (Haemophilus influenzae)]	76	46	231
94	1	51	365	gi 144313	[6.0 kd ORF (Plasmid ColEI)]	76	73	315
116	2	2151	1678	gi 153841	[pneumococcal surface protein A (Streptococcus pneumoniae)]	76	59	474
123	6	3442	5895	gi 1314297	[ClpC ATPase (Listeria monocytogenes)]	76	59	2454
126	2	2156	2932	gnl PID d101328	[Yq12 (Bacillus subtilis)]	76	61	777
128	10	6973	7797	gi 944944	[purine nucleoside phosphorylase (Bacillus subtilis)]	76	60	825
131	11	6186	5812	gi 1674310	[AE000058] Mycoplasma pneumoniae, MC085 homolog, from H. genitalium (Mycoplasma pneumoniae)]	76	47	375

TABLE 2

S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
139	4	3641	3192	gi 2293302	[AF008220] Yqqa [Bacillus subtilis]	76	53	450
140	14	14872	12536	gi 1184680	[polynucleotide phosphorylase [Bacillus subtilis]	76	62	2337
143	2	2583	3905	gi 143795	[transfer RNA-Tyr synthetase [Bacillus subtilis]	76	61	1323
170	6	5095	6114	gnl pid d100959	[ycgQ [Bacillus subtilis]	76	44	1020
180	2	1927	557	gi 40019	[ORF 821 (aa 1-821) [Bacillus subtilis]	76	53	1371
191	7	5815	5228	gi 551880	[anthranilate synthase beta subunit [Lactococcus lactis]	76	61	588
195	3	3829	2444	gi 2149905	[D-glutamic acid adding enzyme [Enterococcus faecalis]	76	60	1386
200	3	1914	3629	gi 431272	[lysis protein [Bacillus subtilis]	76	58	1716
201	1	431	207	gi 2208998	[dextran glucosidase DxsS [Streptococcus suis]	76	57	225
214	2	1283	2380	gi 663278	[transposase [Streptococcus pneumoniae]	76	55	1098
225	3	2338	3411	gi 1552775	[ATP-binding protein [Escherichia coli]	76	56	1074
233	1	2	724	gi 1163115	[neuraminidase B [Streptococcus pneumoniae]	76	60	723
347	1	523	38	gi 537033	[ORF_f356 [Escherichia coli]	76	60	486
356	2	842	165	gi 2149905	[D-glutamic acid adding enzyme [Enterococcus faecalis]	76	61	678
366	3	734	348	gi 149520	[phosphoribosyl anthranilate isomerase [Lactococcus lactis]	76	69	387
5	8	12599	11484	gi 1574293	[fimbrial transcription regulation repressor (pilB) [Haemophilus influenzae]	75	61	1116
6	13	12553	11894	gnl pid d102050	[ydlH [Bacillus subtilis]	75	51	660
9	10	7282	6062	gi 142538	[aspartate aminotransferase [Bacillus sp.]	75	55	1221
10	12	8080	7940	gi 149493	[SCRPI methylase [Lactococcus lactis]	75	56	141
18	5	4266	3301	gnl pid d101319	[Yqgh [Bacillus subtilis]	75	52	966
22	4	1838	2728	gi 1373157	[orf-X; hypothetical protein; Method: conceptual translation supplied by author [Bacillus subtilis]	75	62	891
30	11	9015	7828	gi 153801	[enzyme scr-II [Streptococcus mutans]	75	64	1188
31	5	2362	2030	gi 2293211	[AF008220] putative thioresoxin [Bacillus subtilis]	75	53	333
32	9	7884	8359	gnl pid d100560	[formamidopyrimidine-DNA glycosylase [Streptococcus mutans]	75	61	876
33	4	1735	1448	gi 413976	[ipa-52r gene product [Bacillus subtilis]	75	53	288
33	10	6470	5769	gi 533105	[unknown [Bacillus subtilis]	75	56	702

TABLE 2

S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	Match accession	Match gene name	% sim	% ident	Length (nt)
33	12	6878	7183	gi A0205 FECL	ferredoxin (4Fe-4S) - Clostridium thermaceticum	75	56	306
36	1	181	2	gi 2088739	(AF003141) strong similarity to the PABP/P2/CRBP/CRABP family of transporters [Caenorhabditis elegans]	75	43	180
38	22	14510	15379	gi 1574058	hypothetical [Haemophilus influenzae]	75	56	870
48	33	23398	24066	gi 1930092	outer membrane protein [Campylobacter jejuni]	75	56	669
51	1	2	319	gi 43985	infS-like gene [Lactobacillus delbrueckii]	75	55	318
51	10	8318	11683	gi 537192	CG Site No. 620; alternate gene names hr, hap, hsr, rmx apparent frameshift in GenBank Accession Number X06545 [Escherichia coli]	75	50	3366
54	18	19566	20759	gi 666069	orf2 gene product [Lactobacillus leichmannii]	75	58	1194
57	9	8448	7822	gi 290561	o188 [Escherichia coli]	75	50	627
65	14	6072	6356	gi 606241	30S ribosomal subunit protein S14 [Escherichia coli]	75	64	285
70	4	3071	2472	gi 1256617	adenine phosphoribosyltransferase [Bacillus subtilis]	75	57	600
71	24	30399	29404	gi 1574390	C4-dicarboxylate transport protein [Haemophilus influenzae]	75	57	996
73	2	910	455	gnl pid e249656	ynef [Bacillus subtilis]	75	57	456
79	1	1810	491	gi 1146219	28.2% of identity to the Escherichia coli GTP-binding protein Era; putative [Bacillus subtilis]	75	59	1320
82	6	6360	6536	gi 1655715	BstD [Rhodobacter capsulatus]	75	55	177
83	6	1938	2975	gnl pid e323529	putative Plax protein [Bacillus subtilis]	75	56	1038
93	11	7368	5317	gi 39989	methionyl-tRNA synthetase [Bacillus stearothermophilus]	75	58	2052
93	13	9409	8699	gi 1591493	glutamine transport ATP-binding protein Q [Methanococcus jannaschii]	75	54	711
95	1	1795	47	gnl pid e323510	YioV protein [Bacillus subtilis]	75	57	1749
103	2	362	1186	gnl pid e266928	unknown [Mycobacterium tuberculosis]	75	64	825
104	1	691	915	gi 460026	repressor protein [Streptococcus pneumoniae]	75	54	225
113	5	2951	3883	gnl pid d101119	ABC transporter subunit [Synecocystis sp.]	75	55	933
121	1	320	1390	gi 2145131	repressor of class I heat shock gene expression HrcA [Streptococcus mutans]	75	58	1071
127	6	2614	3000	gi 1500451	M. jannaschii predicted coding region MJ1558 [Methanococcus jannaschii]	75	44	387
137	18	10082	10687	gi 393116	P-glycoprotein 5 [Entamoeba histolytica]	75	52	606
149	11	8499	9338	gnl pid d100582	unknown [Bacillus subtilis]	75	55	840

TABLE 2  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
151	6	9100	7673	gi 40467	[HsdS polypeptide, part of CfrA family [Citrobacter freundii]]	75	57	1428
158	1	986	3	gnl pid e253891	[UDP-glucose 4-epimerase [Bacillus subtilis]]	75	63	984
172	8	5653	6774	gi 142978	[glycerol dehydrogenase [Bacillus stearothermophilus]]	75	56	1122
172	9	7139	9730	gnl pid e268456	[unknown [Mycobacterium tuberculosis]]	75	58	2592
173	1	261	79	gnl pid e236469	[C10C5.6 [Caenorhabditis elegans]]	75	50	183
185	3	3066	2014	gi 1574806	[spermidine/putrescine transport ATP-binding protein (potA) [Haemophilus influenzae]]	75	56	1053
191	6	5235	4213	gi 149518	[phosphoribosyl anthranilate transferase [Lactococcus lactis]]	75	61	1023
226	2	1774	1181	gi 2314588	[AE000642] conserved hypothetical protein [Helicobacter pylori]	75	65	594
231	1	1	153	gi 40173	[homolog of E.coli ribosomal protein L21 [Bacillus subtilis]]	75	57	153
234	1	2	418	gi 2293259	[AF008220] Ytqi [Bacillus subtilis]]	75	59	417
279	1	552	151	gi 1119198	[unknown protein [Bacillus subtilis]]	75	50	402
291	7	3558	3827	gi 40011	[ORF17 (AA 1-161) [Bacillus subtilis]]	75	48	270
375	2	137	628	gi 410137	[ORFX13 [Bacillus subtilis]]	75	58	492
6	20	16721	17560	gi 2293323	[AF008220] Ytdi [Bacillus subtilis]]	74	53	840
7	6	4682	6052	gi 1354211	[PET12-like protein [Bacillus subtilis]]	74	60	1371
18	4	3341	2427	gnl pid d101319	[Yqgi [Bacillus subtilis]]	74	54	915
21	6	5885	4800	gi 1072381	[glutaryl-aminopeptidase [Lactococcus lactis]]	74	59	1086
24	2	739	548	gi 2314762	[AE000655]-ABC transporter, permease protein (yaeB) [Helicobacter pylori]	74	46	192
25	1	2	367	gnl pid d100932	[H2O-forming NADH Oxidase [Streptococcus mutans]]	74	63	366
38	18	11432	12964	gi 537034	[ORF_0488 [Escherichia coli]]	74	57	1533
48	10	8924	6669	gi 1513069	[P-type adenosine triphosphatase [Listeria monocytogenes]]	74	53	2256
55	11	11964	11401	gnl pid e283110	[femD [Staphylococcus aureus]]	74	64	564
61	2	1782	427	gi 2293216	[AF008220] putative UDP-N-acetylmuramate-alanine ligase [Bacillus subtilis]]	74	55	1356
76	10	9414	8065	gnl pid d101325	[Yqib [Bacillus subtilis]]	74	54	1350
83	2	666	926	pir C33496 C334	[hisc homolog - Bacillus subtilis]	74	55	261
86	9	8985	8080	gi 683585	[prephenate dehydratase [Lactococcus lactis]]	74	55	906

TABLE 2  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
102	5	5005	5652	gi 141394	OMP-PRPP transferase (Bacillus subtilis)	74	57	648
103	5	4364	3267	gnl PID e323524	Y10N protein (Bacillus subtilis)	74	62	1098
108	7	6864	7592	gnl PID e257631	methyltransferase (Lactococcus lactis)	74	56	729
131	2	478	146	gnl PID d101320	Yqg2 (Bacillus subtilis)	74	45	333
133	2	1380	919	gnl PID e313025	hypothetical protein (Bacillus subtilis)	74	60	462
137	9	6167	6787	gnl PID d100479	Na <sup>+</sup> ATPase subunit D (Enterococcus hirae)	74	53	621
149	4	3008	3883	gnl PID d100581	high level kasgmycin resistance (Bacillus subtilis)	74	55	876
157	2	243	824	gi 1573373	methylated-DNA--protein-cysteine methyltransferase (dat1) (Haemophilus influenzae)	74	48	582
164	6	3515	4249	gi 410131	ORFX7 (Bacillus subtilis)	74	48	735
167	7	5446	5201	gi 413927	lipa-3r gene product (Bacillus subtilis)	74	55	246
171	1	1	1818	gnl PID d102251	beta-galactosidase (Bacillus circulans)	74	62	1818
172	4	1064	2392	gi 466474	cellobiose phosphotransferase enzyme II'' (Bacillus stearothermophilus)	74	50	1329
185	1	326	3	gi 1573646	Mg(2+) transport ATPase protein C (mgcC) (SP:P22037) (Haemophilus influenzae)	74	68	324
188	2	1089	2018	gi 1573008	ATP dependent translocator homolog (msba) (Haemophilus influenzae)	74	44	930
189	11	6491	7174	gi 1661199	sakacin A production response regulator (Streptococcus mutans)	74	60	684
210	2	520	1287	gi 2293207	[AF008220] YtaQ (Bacillus subtilis)	74	60	768
261	1	836	192	gi 666983	putative ATP binding subunit (Bacillus subtilis)	74	55	645
263	3	1619	3655	gi 663232	Similarity with S. cerevisiae hypothetical 137.7 kD protein in subtelomeric Y' repeat region (Saccharomyces cerevisiae)	74	42	2037
265	2	844	1227	gi 49272	Asparaginase (Bacillus licheniformis)	74	64	384
368	1	1	942	gi 603998	unknown (Saccharomyces cerevisiae)	74	39	942
7	16	13357	11921	gnl PID d101324	Yqpx (Bacillus subtilis)	73	57	1437
17	10	5706	5449	gnl PID e303362	unnamed protein product (Streptococcus thermophilus)	73	47	258
31	2	522	244	gnl PID d100576	single strand DNA binding protein (Bacillus subtilis)	73	55	279
32	6	5667	6194	gnl PID d101315	YqfG (Bacillus subtilis)	73	58	528
34	15	10281	9790	gnl PID d102151	[AB001684] ORF42c (Chlorella vulgaris)	73	46	492



TABLE 2  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
40	12	9876	9226	gi 1173517	riboflavin synthase alpha subunit [Actinobacillus pleuropneumoniae]	73	55	651
55	2	3592	839	gnl PID d101887	cation-transporting ATPase Pacl [Synecocystis sp.]	73	60	2754
55	18	17494	16586	gnl PID e265580	unknown [Mycobacterium tuberculosis]	73	52	909
65	16	7213	7767	gi 143419	ribosomal protein L6 [Bacillus stearothermophilus]	73	60	555
66	3	3300	3659	gnl PID e269883	lacF [lactobacillus casei]	73	52	360
70	10	5557	5733	gi 1857631	envelope protein [Human immunodeficiency virus type 1]	73	60	177
71	4	6133	8262	gnl PID e22063	ss-1,4-galactosyltransferase [Streptococcus pneumoniae]	73	45	2130
72	1	3	851	gi 2293177	[AF008220] transporter [Bacillus subtilis]	73	50	849
76	7	7019	6195	gnl PID d101325	Yqif [Bacillus subtilis]	73	66	825
76	12	10009	9533	gi 1573086	uridine kinase [uridine monophosphokinase] (udk) [Haemophilus influenzae]	73	54	477
80	7	8113	9372	gi 1377823	aminopeptidase [Bacillus subtilis]	73	60	1260
97	5	3389	1668	gnl PID d101954	dihydroxyacid dehydratase [Synecocystis sp.]	73	54	1722
98	9	6912	7619	gnl PID e314991	FtsE [Mycobacterium tuberculosis]	73	54	708
108	11	10928	10440	gi 388109	regulatory protein [Enterococcus faecalis]	73	54	489
128	6	3632	4222	gi 1685111	orf1091 [Streptococcus thermophilus]	73	63	591
138	2	1575	394	gi 147326	transport protein [Escherichia coli]	73	60	1182
140	13	12538	11903	pir E53402 E534	serine O-acetyltransferase (EC 2.3.1.30) - Bacillus stearothermophilus	73	55	636
162	5	5701	4991	gnl PID e323511	putative YhaQ protein [Bacillus subtilis]	73	50	711
164	4	2323	2790	gi 1592076	hypothetical protein (SP.P25768) [Methanococcus jannaschii]	73	52	468
164	8	4815	5346	gi 410137	ORFX13 [Bacillus subtilis]	73	56	732
170	5	4394	5302	gnl PID d100959	homologue of unidentified protein of E. coli [Bacillus subtilis]	73	46	909
178	7	3893	4855	gi 46242	modulation protein B, 5'-end [Rhizobium loti]	73	56	963
204	6	5096	4278	gnl PID e214719	PICR protein [Bacillus thuringiensis]	73	41	819
213	2	832	2037	gi 1565296	ribosomal protein S1 homologue; sequence specific DNA-binding protein [Leuconostoc lactis]	73	55	1206
231	2	84	287	gi 40173	homolog of E. coli ribosomal protein L21 [Bacillus subtilis]	73	61	204
237	1	2	505	gi 1773151	adenine phosphoribosyltransferase [Escherichia coli]	73	51	504

TABLE 2

S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
269	1	2	691	gnl PID d101328	YqIX [Bacillus subtilis]	73	36	690
289	2	1272	832	p1r A02771 87WC	ribosomal protein L7/L12 - Micrococcus luteus	73	66	441
343	1	14	484	gfi 1788125	(AE000276) hypothetical 30.4 kD protein in man2-cspC intergenic region [Escherichia coli]	73	47	471
356	1	222	4	gfi 2149905	D-glutamic acid adding enzyme [Enterococcus faecalis]	73	50	219
7	5	3165	4691	gnl PID d101833	amidase [Synechocystis sp.]	72	52	1527
7	9	7195	7647	gfi 1465976	nusB [Escherichia coli]	72	54	453
7	17	13743	13300	gnl PID e289141	similar to hydroxymyristoyl-(acyl carrier protein) dehydratase [Bacillus subtilis]	72	59	444
22	19	15637	16224	gnl PID d101929	ribosome releasing factor [Synechocystis sp.]	72	51	588
33	17	12111	11425	gnl PID d101190	ORE3 [Streptococcus mutans]	72	55	687
34	7	7147	5627	gfi 196501	aspartyl-tRNA synthetase [Thermus thermophilus]	72	52	1521
38	23	15372	16085	p1r H64108 H641	L-ribulose-phosphate 4-epimerase (araD) homolog - Haemophilus influenzae (strain Rd KW20)	72	54	714
39	5	5094	6905	gnl PID e254877	unknown [Mycobacterium tuberculosis]	72	56	1812
40	6	4469	4636	gfi 153672	lactose repressor [Streptococcus mutans]	72	58	168
48	2	1459	1253	gfi 310380	inhibin beta-A-subunit [Ovis aries]	72	33	207
48	29	21729	22424	gfi 2314329	(AE000623) glutamine ABC transporter, permease protein (glnP) [Helicobacter pylori]	72	49	696
50	5	4529	3288	gfi 1750108	YnBA [Bacillus subtilis]	72	54	1242
51	3	1044	2282	gfi 2293230	(AF008220) YtbJ [Bacillus subtilis]	72	54	1239
52	13	13681	13938	gfi 142521	deoxyribodipyrimidine photolyase [Bacillus subtilis]	72	45	258
55	1	841	35	gfi 882518	ORF_0304; OTG start [Escherichia coli]	72	59	807
75	5	2832	3191	gnl PID e209886	mercuric resistance operon regulatory protein [Bacillus subtilis]	72	44	360
76	6	6229	5771	gfi 142450	ahrC protein [Bacillus subtilis]	72	53	459
79	5	5065	4592	gfi 2293279	(AF008220) YtcG [Bacillus subtilis]	72	46	474
87	14	14726	12309	gnl PID e323502	putative PriA protein [Bacillus subtilis]	72	52	2418
91	1	444	562	gfi 500691	MYO1 gene product [Saccharomyces cerevisiae]	72	50	219
91	7	4516	4764	gfi 829615	skeletal muscle sodium channel alpha-subunit [Equus caballus]	72	38	249

TABLE 2

S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
95	2	2004	1717	gnl pid e323527	putative Asp23 protein (Bacillus subtilis)	72	40	288
109	1	1452	118	gi 143331	alkaline phosphatase regulatory protein (Bacillus subtilis)	72	52	1335
126	1	3	2192	gnl pid d101831	glutamine-binding periplasmic protein (Synechocystis sp.)	72	46	2190
130	3	1735	2478	gi 2415396	(AP015775) carboxypeptidase (Bacillus subtilis)	72	53	744
137	6	2585	2929	gi 472922	v-type Na-ATPase (Enterococcus hirae)	72	46	345
140	10	9601	9203	gi 49224	JURF 4 (Synechococcus sp.)	72	48	399
146	5	1906	1247	gnl pid e324945	hypothetical protein (Bacillus subtilis)	72	45	660
147	2	2084	1083	gnl pid e325016	hypothetical protein (Bacillus subtilis)	72	56	1002
147	5	6156	5146	gi 472327	TPP-dependent acetoin dehydrogenase beta-subunit (Clostridium magnum)	72	56	1011
148	8	5381	6433	gi 574332	NAD(P)H-dependent dihydroxyacetone-phosphate reductase (Bacillus subtilis)	72	54	1053
148	14	10256	9675	gnl pid d101319	YqgN (Bacillus subtilis)	72	50	582
159	8	4005	4949	gi 1788770	(AE000330) 0463: 24 pct identical (44 gaps) to 338 residues from penicillin-binding protein 4*, PBPB_BACSU SW: P3959 (451 aa) (Escherichia coli)	72	43	945
172	10	9907	10620	gi 763387	unknown (Saccharomyces cerevisiae)	72	55	714
220	3	2862	3602	gi 1574175	hypothetical (Haemophilus influenzae)	72	50	741
267	1	3	449	gi 290513	1470 (Escherichia coli)	72	48	447
281	2	899	540	gnl pid d100964	homologue of aspartokinase 2 alpha and beta subunits LysC of B. subtilis (Bacillus subtilis)	72	45	360
290	1	1018	14	gi 474195	This ORF is homologous to a 40.0 kd hypothetical protein in the htrB 3' region from E. coli, Accession Number X61000 (Mycoplasma-like organism)	72	54	1005
300	1	63	587	gi 746399	transcription elongation factor (Escherichia coli)	72	50	525
316	1	1326	4	gi 158127	protein kinase C (Drosophila melanogaster)	72	40	1323
342	1	227	3	gnl pid d101164	unknown (Bacillus subtilis)	72	54	225
354	1	1	1005	gnl pid d102048	C. thermocellum beta-glucosidase; P26208 (985) (Bacillus subtilis)	72	52	1005
6	10	8134	10467	gnl pid e264229	unknown (Mycobacterium tuberculosis)	71	57	2334
7	20	16231	15464	gi 18046	[3-oxoacyl-(acyl-carrier protein) reductase (Cuphea lanceolata)	71	52	768
15	1	1297	2	gnl pid d100571	replicative DNA helicase (Bacillus subtilis)	71	51	1396
15	4	4435	3669	gi 499184	orf189 (Bacillus subtilis)	71	47	567

**TABLE 2**  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
18	6	5120	4218	gnl pid d101318	YggG (Bacillus subtilis)	71	51	903
29	1	1	540	gi 1773142	similar to the 20.2kd protein in T87B-EXOA region of B. subtilis [Escherichia coli]	71	56	540
38	20	13327	13830	gi 537036	ORF_0158 (Escherichia coli)	71	48	504
51	12	15015	12676	gi 149528	dipeptidyl peptidase IV [Lactococcus lactis]	71	55	2340
55	23	21040	20585	gi 2343285	[AF015453] surface located protein [Lactobacillus rhamnosus]	71	58	456
60	2	705	265	gnl pid d101320	YggZ (Bacillus subtilis)	71	44	441
71	18	24679	26226	gi 580920	rodD (gtaA) polypeptide (AA 1-673) [Bacillus subtilis]	71	44	1548
71	25	30587	30360	gi 606028	ORF_0414: Geneplot suggests frameshift near start but none found [Escherichia coli]	71	50	228
72	6	5239	6729	gi 580835	lysine decarboxylase [Bacillus subtilis]	71	48	1491
72	14	11991	12878	gi 624085	similar to rat beta-alanine synthetase encoded by GenBank Accession Number S27881; contains ATP/GTP binding motif (Paramacium bursaria Chlorella virus 1)	71	54	888
73	11	7269	7033	gi 1906594	PNI (Rattus norvegicus)	71	42	237
74	6	10385	8517	gi 1573733	prolyl-tRNA synthetase (proS) [Haemophilus influenzae]	71	52	1869
81	9	5772	6578	gi 147404	mannose permease subunit II-M-Han [Escherichia coli]	71	45	807
86	5	4602	3604	gnl pid e322063	ss-1,4-galactosyltransferase [Streptococcus pneumoniae]	71	53	999
105	4	3619	4707	gi 2323341	[AF014460] PepQ [Streptococcus mutans]	71	58	1089
106	13	13557	12955	gi 1519287	LemA [Listeria monocytogenes]	71	48	603
114	2	1029	1979	gi 310303	mosA [Rhizobium meliloti]	71	55	951
122	2	564	1205	gi 1649037	glutamine transport ATP-binding protein GLNQ [Salmonella typhimurium]	71	50	642
132	5	9018	7063	gnl pid d102049	H. influenzae hypothetical ABC transporter; P44808 (974) [Bacillus subtilis]	71	51	1956
140	1	1141	227	gi 1673788	(A2000015) Mycoplasma pneumoniae, fructose-bisphosphate aldolase; similar to Swiss-Prot Accession Number P13243, from B. subtilis [Mycoplasma pneumoniae]	71	49	915
140	5	5635	4973	gnl pid d100964	homologue of hypothetical protein in a rapamycin synthesis gene cluster of Streptomyces hygroscopicus [Bacillus subtilis]	71	48	663
141	7	7369	7845	gnl pid d102005	(AB001488) FUNCTION UNKNOWN, SIMILAR PRODUCT IN E. COLI AND MYCOPLASMA PNEUMONIAE. [Bacillus subtilis]	71	51	477

TABLE 2  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
193	1	1	165	gi 46912	ribosomal protein L13 [Staphylococcus carnosus]	71	59	165
194	3	2205	1594	gi 535351	CodY [Bacillus subtilis]	71	52	612
199	3	1510	1319	gi 2182574	[AE000090] Y4Pe [Rhizobium sp. NGR234]	71	45	192
208	2	2616	3752	gi 1787378	[AE000213] hypothetical protein in purB 5' region [Escherichia coli]	71	57	1137
209	2	2022	1141	gi 41432	[fepC gene product [Escherichia coli]	71	46	882
210	5	1911	3071	gi 49316	ORF2 gene product [Bacillus subtilis]	71	45	1161
210	6	3069	3386	gi 580900	ORF3 gene product [Bacillus subtilis]	71	48	318
212	2	3561	1381	gi 557567	ribonucleotide reductase R1 subunit [Mycobacterium tuberculosis]	71	53	2181
213	3	2003	2920	gnl pid d101320	YqgR [Bacillus subtilis]	71	50	918
244	1	13	1053	gnl pid d100964	homologue of aspartokinase 2 alpha and beta subunits LysC of B. subtilis [Bacillus subtilis]	71	55	1041
251	2	1008	1874	gi 755601	unknown [Bacillus subtilis]	71	46	867
282	2	906	712	gi 1353874	unknown [Rhodospirillum rubrum]	71	46	195
312	4	2137	1565	gnl pid d102245	[AB005554] yxbF [Bacillus subtilis]	71	34	573
338	1	3	683	gi 1591045	hypothetical protein (SP:P31466) [Methanococcus jannaschii]	71	48	681
346	1	3	164	gi 1591234	hypothetical protein (SP:P42297) [Methanococcus jannaschii]	71	36	162
374	1	619	2	gi 397526	clumping factor [Staphylococcus aureus]	71	23	618
377	1	688	2	gi 397526	clumping factor [Staphylococcus aureus]	71	23	687
3	8	7419	6958	gnl pid e269486	Unknown [Bacillus subtilis]	70	42	462
3	10	8395	9075	gnl pid e255543	putative iron dependant repressor [Staphylococcus epidermidis]	70	46	681
7	14	11024	10254	gnl pid d100290	undefined open reading frame [Bacillus stearothermophilus]	70	55	771
7	18	14213	13719	gnl pid d101090	biotin carboxyl carrier protein of acetyl-CoA carboxylase [Synechocystis sp.]	70	56	495
9	2	1057	287	gnl pid d100581	unknown [Bacillus subtilis]	70	52	771
12	4	2610	1789	gnl pid d101195	yycJ [Bacillus subtilis]	70	52	822
21	2	2586	1846	gi 2293447	[AF008930] ATPase [Bacillus subtilis]	70	54	741
22	13	110955	11512	gi 1165295	ydr540cp [Saccharomyces cerevisiae]	70	50	558
30	6	4315	3980	gi 39478	ATP binding protein of transport ATPases [Bacillus firmus]	70	51	336

TABLE 2  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
31	1	370	113	gi 662792	single-stranded DNA binding protein (unidentified eubacterium)	70	36	258
33	15	11059	9321	gi 1161219	homologous to D-amino acid dehydrogenase enzyme (Pseudomonas aeruginosa)	70	50	1119
38	6	3812	4312	gi 2058547	ConyD (Streptococcus gordonii)	70	48	501
38	25	11786	18477	gi 537033	ORF f356 (Escherichia coli)	70	58	492
40	13	11054	9846	gi 1173516	riboflavin-specific deaminase (Actinobacillus pleuropneumoniae)	70	52	1209
42	2	722	1954	gi 1146183	putative (Bacillus subtilis)	70	51	1233
43	3	2373	1612	gi 1591493	glutamine transport ATP-binding protein Q (Methanococcus jannaschii)	70	48	762
45	8	9197	8049	gnl PID d102036	subunit of ADP-glucose pyrophosphorylase (Bacillus stearothermophilus)	70	54	1149
59	2	567	956	gnl PID d100302	neopullulanase (Bacillus sp.)	70	42	390
60	3	1874	795	gnl PID e276466	aminopeptidase P (Lactococcus lactis)	70	48	1080
61	4	5553	2437	gnl PID e275074	SNF (Bacillus cereus)	70	51	3117
61	7	7914	6802	gi 1573037	cystathionine gamma-synthase (metB) (Haemophilus influenzae)	70	52	1113
63	7	5372	7222	gnl PID d100974	unknown (Bacillus subtilis)	70	54	1851
68	7	7126	6962	gi 1263014	emm18.1 gene product (Streptococcus pyogenes)	70	37	165
72	12	10081	10911	gi 2313093	(AE000524) carboxymorpermidine decarboxylase (nspC) (Helicobacter pylori)	70	56	831
75	10	7888	8124	gi 1877423	galactose-1-P-uridylyl transferase (Streptococcus mutans)	70	59	237
79	3	3424	2525	gi 39881	ORF 311 (AA 1-311) (Bacillus subtilis)	70	47	900
87	10	9369	7324	gnl PID e323506	putative Pkn2 protein (Bacillus subtilis)	70	52	2046
96	14	10640	11788	gi 1573209	tRNA-guanine transglycosylase (tgt) (Haemophilus influenzae)	70	52	1149
113	2	574	1086	gi 433630	A180 (Saccharomyces cerevisiae)	70	59	513
123	5	2901	3461	gnl PID d100585	unknown (Bacillus subtilis)	70	45	561
125	5	4593	4282	gnl PID e276474	capacitative calcium entry channel 1 (Bos taurus)	70	35	312
129	5	4500	3454	gnl PID d101314	Yqet (Bacillus subtilis)	70	47	1047
133	3	2608	1394	gi 2293312	(AF008220) Yefp (Bacillus subtilis)	70	50	1215
135	1	420	662	gnl PID e265530	yofE (Streptococcus pneumoniae)	70	47	243
137	3	438	932	gi 472919	v-type Na-ATPase (Enterococcus hirae)	70	57	495
138	1	440	3	gi 147336	transmembrane protein (Escherichia coli)	70	42	438

**TABLE 2**  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
140	16	18796	16364	gi 976441	N5-methyltetrahydrofolate homocysteine methyltransferase [Saccharomyces cerevisiae]	70	53	2433
167	10	8263	6695	gi 149535	D-alanine activating enzyme [Lactobacillus casei]	70	52	1569
204	4	3226	2747	gnl PID d102049	E. coli hypothetical protein; P31805 (267) [Bacillus subtilis]	70	51	480
207	3	2627	2869	gnl PID e309213	racGAP [Dictyostelium discoideum]	70	45	243
282	3	1136	882	gi 1353874	unknown [Rhodobacter capsulatus]	70	50	255
6	21	17554	18453	gnl PID e233879	hypothetical protein [Bacillus subtilis]	69	44	900
6	22	18482	19471	gi 580883	ipa-88d gene product [Bacillus subtilis]	69	53	990
22	6	4682	5824	gi 2209379	[AF006720] ProJ [Bacillus subtilis]	69	48	1143
22	9	7992	8651	gnl PID d100580	unknown [Bacillus subtilis]	69	51	660
22	12	9871	10767	gnl PID d100581	unknown [Bacillus subtilis]	69	51	897
27	7	5857	5348	gnl PID d102012	[AB001488] FUNCTION UNKNOWN. [Bacillus subtilis]	69	28	510
36	10	7294	10116	gi 437916	isoleucyl-tRNA synthetase [Staphylococcus aureus]	69	53	2823
38	1	2	1090	gi 141900	alcohol dehydrogenase (EC 1.1.1.1) [Alcaligenes eutrophus]	69	48	1089
40	14	11333	11944	gi 1573280	Holliday junction DNA helicase (ruva) [Haemophilus influenzae]	69	44	612
40	15	11942	12517	gi 1573653	[DNA-3-methyladenine glycosidase I (tagI) [Haemophilus influenzae]	69	50	576
45	6	6947	5490	gi 580887	starch (bacterial glycogen) synthase [Bacillus subtilis]	69	47	1458
48	34	24932	24153	gnl PID e233870	hypothetical protein [Bacillus subtilis]	69	36	780
49	6	6183	6521	gi 396297	[similar to phosphotransferase system enzyme II [Escherichia coli]	69	50	339
49	8	7586	8338	gi 396420	[similar to Alcaligenes eutrophus phgI D-ribulose-5-phosphate 3 epimerase [Escherichia coli]	69	49	753
55	6	8262	7033	gi 1146238	[poly(A) polymerase [Bacillus subtilis]	69	50	1230
59	3	954	2333	gnl PID e313038	hypothetical protein [Bacillus subtilis]	69	54	1380
62	3	1170	1418	gnl PID d101915	hypothetical protein [Synechocystis sp.]	69	49	249
63	8	7298	7762	gi 293017	ORF3 (put.): putative [Lactococcus lactis]	69	42	465
66	4	3657	5081	gi 153755	phospho-beta-D-galactosidase (EC 3.2.1.85) [Lactococcus lactis cremoris]	69	49	1425
66	5	5126	6829	gi 433809	enzyme II [Streptococcus mutans]	69	46	1704
71	6	10017	10664	gnl PID e322063	ss-1,4-galactosyltransferase [Streptococcus pneumoniae]	69	39	648

TABLE 2

S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
71	121	27730	27966	gnl pid d100649	DE-cadherin [Drosophila melanogaster]	69	30	237
77	1	1	237	gll 287870	[groES gene product [Lactococcus lactis]	69	44	237
81	5	3622	4101	gll 1573605	[fucose operon protein (fucU) [Haemophilus influenzae]	69	52	480
83	1	40	714	gll C33496 C334	hisc homolog - Bacillus subtilis	69	46	675
83	16	15742	16335	gll 143372	[phosphoribosyl glycylamide formyltransferase (PUR-N) [Bacillus subtilis]	69	46	594
85	2	1212	916	gll 194097	[IFN-response element binding factor 1 [Mus musculus]	69	48	297
91	5	3678	4274	gll 1574712	[anaerobic ribonucleoside-triphosphate reductase activating protein (nrdG) [Haemophilus influenzae]	69	44	597
98	5	3247	4032	gnl pid d100262	[livP protein [Salmonella typhimurium]	69	51	786
108	5	4085	5056	gnl pid e257629	[transcription factor [Lactococcus lactis]	69	49	972
126	3	3078	4568	gnl pid d101329	[yqjJ [Bacillus subtilis]	69	49	1491
131	6	4121	2889	gnl pid d101314	[yqer [Bacillus subtilis]	69	47	1233
136	2	1505	2299	gnl pid d100581	[unknown [Bacillus subtilis]	69	47	795
149	5	3852	4763	gnl pid e323525	[vliQ protein [Bacillus subtilis]	69	50	912
149	12	9336	10655	gll 151571	[Homology with E.coli and P.aeruginosa lysA gene; product of unknown function; putative [Pseudomonas syringae]	69	52	1320
153	4	3191	3829	gll 1710373	[arnQ [Bacillus subtilis]	69	44	639
169	3	849	2324	gnl pid d100582	[temperature sensitive cell division [Bacillus subtilis]	69	49	1476
180	1	566	3	gll 488339	[alpha-amylase [unidentified cloning vector]	69	50	564
212	1	1196	231	gll 1395209	[ribonucleotide reductase R2-2 small subunit [Mycobacterium tuberculosis]	69	53	966
226	1	2	661	gll JQ2285 JQ22	[modulin-26 - soybean	69	41	660
233	5	3249	4766	gll 472918	[v-type Na-ATPase [Enterococcus hirae]	69	56	1518
235	3	560	1766	gll 148945	[methylase [Haemophilus influenzae]	69	43	1107
243	2	865	2361	gnl pid d100225	[ORF5 [Barley yellow dwarf virus]	69	69	1497
251	3	2899	1967	gll 2289231	[macrolide-efflux protein [Streptococcus agalactiae]	69	51	933
310	1	1	282	gnl pid e322442	[peptide deformylase [Clostridium beijerinckii]	69	55	282
369	1	868	2	gll 397526	[clumping factor [Staphylococcus aureus]	69	22	867
370	1	749	3	gll 397526	[clumping factor [Staphylococcus aureus]	69	21	747



TABLE 2  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
379	1	44	280	[gnl pid d100649]	[DE-cadherin (Drosophila melanogaster)]	69	30	237
388	1	260	72	[gi 1787524]	[AE000225] hypothetical 32.7 kD protein in trpL-bur intergenic region [Escherichia coli]	69	44	189
1	2	2006	3040	[gnl pid d101809]	[ABC transporter (Synechocystis sp.)]	68	43	1035
12	5	3958	2600	[gi 2182992]	[histidine kinase (Lactococcus lactis cremoris)]	68	45	1359
15	2	1790	1311	[pir S16974 SBS]	[ribosomal protein L9 - Bacillus stearothermophilus]	68	56	480
16	6	7353	5701	[gi 1787041]	[AE000184] 0530: This 530 aa orf is 33 pct identical (14 gaps) to 525 residues of an approx. 640 aa protein YHES_HABIN SM: P44808 [Escherichia coli]	68	45	1653
17	12	6479	6805	[gi 553165]	[acetylcholinesterase (Homo sapiens)]	68	68	327
20	13	14128	14505	[gi 142700]	[P competence protein (ttg start codon) (put.) putative (Bacillus subtilis)]	68	40	378
22	32	24612	25397	[gi 289262]	[comE ORF3 (Bacillus subtilis)]	68	36	786
30	7	4548	4288	[gi 311388]	[ORF1 (Azorhizobium caulinodans)]	68	46	261
36	5	3911	4585	[gi 1573041]	[hypothetical (Haemophilus influenzae)]	68	54	675
46	6	5219	6040	[gi 1790131]	[AE000446] hypothetical 29.7 kD protein in ibpA-gyrB intergenic region [Escherichia coli]	68	47	822
54	10	6235	7086	[gi 882579]	[CG Site No. 29739 (Escherichia coli)]	68	55	852
55	5	7069	5165	[gnl pid d101914]	[ABC transporter (Synechocystis sp.)]	68	45	1905
71	3	6134	5613	[gi 1573353]	[outer membrane integrity protein (tolA) (Haemophilus influenzae)]	68	50	522
71	10	15342	16613	[gi 580866]	[ipa-12d gene product (Bacillus subtilis)]	68	31	1272
71	12	17560	18792	[gi 44073]	[SecY protein (Lactococcus lactis)]	68	35	1233
71	17	22295	24703	[gi 1762349]	[involved in protein export (Bacillus subtilis)]	68	50	2409
73	16	10208	9729	[gi 1353537]	[dUTPase (Bacteriophage rit)]	68	51	480
86	18	17198	16011	[gi 413943]	[ipa-19d gene product (Bacillus subtilis)]	68	53	1188
87	17	17491	15866	[gi 150209]	[ORF 1 (Mycoplasma mycoides)]	68	43	1626
89	6	5139	4354	[gi 1498824]	[M. jannaschii predicted coding region MJ0062 (Methanococcus jannaschii)]	68	40	786
89	11	8021	8242	[gi 150974]	[4-oxalocrotonate tautomerase (Pseudomonas putida)]	68	43	222
97	8	6755	5394	[gi 2367358]	[AE000491] hypothetical 52.9 kD protein in aldB-rpsF intergenic region [Escherichia coli]	68	41	1362

**TABLE 2**  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
98	3	1418	2308	[gnl PID d100261]	LtVA protein [Salmonella typhimurium]	68	40	891
99	13	16414	17280	[gi 455363]	regulatory protein [Streptococcus mutans]	68	50	867
115	3	5054	3693	[gi 466474]	cellulose phosphorylase enzyme II'' [Bacillus stearothermophilus]	68	44	1362
124	7	3394	3221	[gnl PID d100702]	cut14 protein [Schizosaccharomyces pombe]	68	56	174
125	2	2923	1922	[gi 450566]	transmembrane protein [Bacillus subtilis]	68	50	1002
132	2	4858	2886	[gnl PID d101732]	DNA ligase [Synecocystis sp.]	68	52	1971
140	7	7765	7580	[gi 1209711]	unknown [Saccharomyces cerevisiae]	68	47	186
150	1	539	3	[gi 402490]	ADP-ribosylarginine hydrolase [Mus musculus]	68	59	537
164	1	58	867	[gnl PID e255114]	glutamate racemase [Bacillus subtilis]	68	49	810
164	2	819	1835	[gnl PID e255117]	hypothetical protein [Bacillus subtilis]	68	50	1017
169	7	3946	4104	[pir B54545 B545]	hypothetical protein - Lactococcus lactis subsp. lactis plasmid pSL2	68	40	159
170	4	4247	4396	[gi 304146]	spore coat protein [Bacillus subtilis]	68	52	150
171	8	6002	7054	[gi 38722]	precursor (aa -20 to 381) [Acinetobacter calcoaceticus]	68	54	1053
198	3	2473	1871	[gnl PID e113075]	hypothetical protein [Bacillus subtilis]	68	46	603
211	2	969	1802	[gi 1439528]	ELIC-man [Lactobacillus curvatus]	68	45	834
214	8	4926	4231	[gnl PID d102049]	H. influenzae hypothetical protein; P43990 (182) [Bacillus subtilis]	68	50	696
217	6	4955	5170	[gnl PID e326966]	similar to B. vulgaris CMS-associated mitochondrial ... (reverse transcriptase) [Arabidopsis thaliana]	68	36	216
218	7	3930	4745	[gi 2293198]	(AF008220) Ytgp [Bacillus subtilis]	68	38	816
220	6	4628	4338	[gnl PID e325791]	(AJ000005) orf1 [Bacillus megaterium]	68	51	291
236	1	746	108	[gi 410137]	ORFX13 [Bacillus subtilis]	68	46	639
237	2	675	1451	[gi 396348]	homoserine transuccinylase [Escherichia coli]	68	49	777
250	4	771	1229	[gi 310859]	ORF2 [Synecococcus sp.]	68	50	459
254	1	517	155	[gi 1787105]	(AE000189) o648 was o669; This 669 aa orf is 40 pct identical (1 gap) to 217 residues of an approx. 232 aa protein YBBA_MAEIN SW: P45247 [Escherichia coli]	68	44	363
337	1	1	774	[gnl PID e261990]	putative orf [Bacillus subtilis]	68	47	774
345	1	3	653	[gi 149513]	thymidylate synthase (EC 2.1.1.45) [Lactococcus lactis]	68	61	651

TABLE 2  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
386	2	417	4	gi1573353	outer membrane integrity protein (toiA) [Haemophilus influenzae]	68	51	414
2	4	5722	4697	gi14592141	M. jannaschii predicted coding region M21507 [Methanococcus jannaschii]	67	26	1026
3	6	5397	4591	gi12293175	[AF008220] signal transduction regulator [Bacillus subtilis]	67	44	807
5	2	2301	574	gi12313385	[A2000547] para-aminobenzoate synthetase (pabB) [Helicobacter pylori]	67	48	1728
6	19	16063	16758	gi1413931	ipa-7d gene product [Bacillus subtilis]	67	41	696
22	8	7094	7897	gi11928962	pyrroline-5-carboxylate reductase [Actinidia deliciosa]	67	51	804
29	10	8335	9072	gi1468745	gcr gene product [Bacillus brevis]	67	41	738
31	3	1379	585	gi12425123	[AF019986] PksB [Dictyostellium discoideum]	67	49	795
32	11	8849	10150	gi142029	ORF1 gene product [Escherichia coli]	67	47	1302
36	16	14830	15546	gi1592142	ABC transporter, probable ATP-binding subunit [Methanococcus jannaschii]	67	43	717
38	9	4958	5392	gnlPID e214803	T22B3.3 [Caenorhabditis elegans]	67	47	435
38	21	13775	14512	gi1537037	ORF_0216 [Escherichia coli]	67	52	738
45	9	10428	9181	gi1551710	branching enzyme (gigB) [EC 2.4.1.18] [Bacillus stearothermophilus]	67	51	1248
48	23	18344	17514	gi1413949	ipa-25d gene product [Bacillus subtilis]	67	50	831
50	2	1773	952	gnlPID d101330	VqJQ [Bacillus subtilis]	67	55	822
53	1	431	3	gi1574291	fimbrial transcription regulation repressor (pilB) [Haemophilus influenzae]	67	40	429
55	13	12740	11946	gnlPID e252990	ORF YDL037c [Saccharomyces cerevisiae]	67	51	795
61	9	9210	8329	gnlPID e264711	ATP-binding cassette transporter A [Staphylococcus aureus]	67	50	882
71	2	5614	6117	gi1197667	[vitellogenin [Anolis pulchellus]	67	36	504
81	7	4489	4983	gi11142714	phosphoenolpyruvate:mannose phosphotransferase element IIB [Lactobacillus curvatus]	67	42	495
83	7	2957	3214	gi1276746	acyl carrier protein [Porphyra purpurea]	67	37	258
86	8	8140	6809	gi11147744	PSR [Enterococcus hirae]	67	45	1332
97	3	986	1366	gnlPID d102235	[AB000631] unnamed protein product [Streptococcus mutans]	67	43	381
102	1	601	1413	gi1682765	mccB gene product [Escherichia coli]	67	36	813
106	3	1109	1987	gi1148921	LicD protein [Haemophilus influenzae]	67	43	879
115	4	5982	5656	gi1895750	putative cellobiose phosphotransferase enzyme III [Bacillus subtilis]	67	44	327

TABLE 2

S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
115	7	8421	8077	gi 466473	cellobiose phosphotransferase enzyme II' [Bacillus stearothermophilus]	67	51	345
127	13	8127	7021	gi 147326	transport protein [Escherichia coli]	67	45	1107
136	3	2215	2859	gn PID d100581	unknown [Bacillus subtilis]			
140	21	23317	20906	gn PID d101912	phenylalanyl-tRNA synthetase [Synecocystis sp.]	67	49	645
146	6	2894	1893	gi 2182994	histidine kinase [Lactococcus lactis cremoris]	67	44	1002
151	8	11476	11117	gn PID d100085	ORF129 [Bacillus cereus]	67	48	360
160	10	7453	8646	gi 2281317	OrfB: similar to a Streptococcus pneumoniae putative membrane protein encoded by GenBank Accession Number X99400; inactivation of the OrfB gene leads to UV-sensitivity and to decrease of homologous recombination (plasmidic test) [Lactococcus 1]	67	46	1194
163	3	3099	4505	gn PID d101317	YqfR [Bacillus subtilis]	67	47	1407
167	8	6704	5454	gi 1161933	DltC [Lactobacillus casei]	67	45	1251
169	4	2322	2879	gn PID d101331	YqG [Bacillus subtilis]	67	41	558
171	11	7656	8384	gi 153841	pneumococcal surface protein A [Streptococcus pneumoniae]	67	50	729
188	3	1930	3723	gi 1542975	ABC8 [Thermoanaerobacterium thermosulfurigenes]	67	46	1794
189	6	3599	3141	gn PID e325178	Hypothetical protein [Bacillus subtilis]	67	52	459
205	3	1663	2231	gi 606073	ORF_0169 [Escherichia coli]	67	47	549
207	4	2896	3456	gi 2276374	DtxR/iron regulated lipoprotein precursor [Corynebacterium diphtheriae]	67	49	561
217	3	4086	3703	gi 895750	putative cellobiose phosphotransferase enzyme III [Bacillus subtilis]	67	42	384
246	2	291	662	gi 1842438	unknown [Bacillus subtilis]	67	43	372
252	1	2	745	gi 2351768	PspA [Streptococcus pneumoniae]	67	41	744
265	3	1134	1811	gi 2313847	[AE000585] L-asparaginase II [ansB] [Helicobacter pylori]	67	42	678
295	1	1	375	gi 2276374	DtxR/iron regulated lipoprotein precursor [Corynebacterium diphtheriae]	67	43	375
1	7	4898	5146	gn PID e255179	unknown [Mycobacterium tuberculosis]	66	56	249
3	1	389	3	gn PID e269548	unknown [Bacillus subtilis]	66	48	387
3	20	19267	20805	gi 39956	IGlc [Bacillus subtilis]	66	50	1539
4	3	2545	2718	gi 1787564	[AE000228] phage shock protein C [Escherichia coli]	66	36	174
5	9	13197	12592	gi 1574291	fibrial transcription regulation repressor (pilB) [Haemophilus influenzae]	66	46	606

TABLE 2

S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
9	4	2872	1451	gnl PID e266928	unknown [Mycobacterium tuberculosis]	66	43	1422
12	2	1469	1200	gi 520407	orf2; GYG start codon [Bacillus thuringiensis]	66	42	270
15	12	10979	9897	gi 2314738	(AE000633) translation elongation factor EF-Ts (tsf) [Helicobacter pylori]	66	49	1083
16	2	1312	734	gnl PID d102245	(AB005554) yxbF [Bacillus subtilis]	66	35	579
22	3	1372	1851	gi 1480916	signal peptidase type II [Lactococcus lactis]	66	38	480
22	7	5828	7096	gnl PID e206261	gamma-glutamyl phosphate reductase [Streptococcus thermophilus]	66	51	1269
22	20	16194	17138	gnl PID e281914	YitL [Bacillus subtilis]	66	50	945
30	2	530	976	gi 2314379	(AE000627) ABC transporter, ATP-binding protein (yhcg) [Helicobacter pylori]	66	40	447
32	1	199	984	gi 312444	ORF2 [Bacillus caldolyticus]	66	49	786
33	13	8352	7234	gi 1387979	44% identity over 302 residues with hypothetical protein from Synechocystis sp. accession 064006.C0; expression induced by environmental stress; some similarity to glycosyl transferases; two potential membrane-spanning helices [Bacillus subtilis]	66	44	1119
34	6	5658	4708	gnl PID e250724	orf2 [Lactobacillus sake]	66	39	951
34	14	9792	9574	gi 1590997	M. jannaschii predicted coding region MJ0272 [Methanococcus jannaschii]	66	48	219
35	16	15163	14501	gi 1773352	Cap5M [Staphylococcus aureus]	66	46	663
36	9	6173	6976	gi 1518680	(minicell)-associated protein DivIVA [Bacillus subtilis]	66	35	804
36	11	10396	10824	bbs 155344	insulin activator factor, INSAP [human, Pancreatic insulinoma, Peptide Partial, 744 aa] [Homo sapiens]	66	43	429
48	1	28	1419	gnl PID e325204	hypothetical protein [Bacillus subtilis]	66	50	1392
48	7	3810	4112	gi 2182574	(AE000090) Y4pE [Rhizobium sp. NGR234]	66	40	303
52	4	3595	2789	gi 388565	major cell-binding factor [Campylobacter jejuni]	66	52	807
54	3	2662	1076	gnl PID d101831	glutamine-binding periplasmic protein [Synechocystis sp.]	66	43	1587
62	10	9740	9183	gnl PID e154144	mdr gene product [Staphylococcus aureus]	66	44	558
72	13	10893	11993	gi 2313129	(AE000526) M. pylori predicted coding region HP0049 [Helicobacter pylori]	66	44	1101
74	9	13267	12476	gi 1573941	hypothetical [Haemophilus influenzae]	66	43	792
75	1	2	868	gi 1574631	nicotinamide mononucleotide transporter (pnuC) [Haemophilus influenzae]	66	48	867
75	7	5303	4275	gi 41312	put. EBG repressor protein [Escherichia coli]	66	40	1029

**TABLE 2**  
*S. pneumoniae* - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
82	7	6813	8123	gnl pid e255128	trigger factor (Bacillus subtilis)	66	53	1311
83	3	905	1219	plr C33496 C334	hisc homolog - Bacillus subtilis	66	44	315
86	10	9407	8925	gi 683584	shikimate kinase (Lactococcus lactis)	66	41	483
88	10	7001	6060	gi 2098719	putative fibrial-associated protein (Actinomyces naeslundii)	66	52	942
89	1	951	4	gi 410118	ORFX19 (Bacillus subtilis)	66	41	948
93	7	3661	2711	gi 1787936	(AE000260) f298; This 298 aa orf is 51 pct identical (5 gaps) to 297 residues of an approx. 304 aa protein VCSN_BACSU SW: R42972 [Escherichia coli]	66	49	951
104	3	1805	3049	gi 1469784	putative cell division protein ftsW (Enterococcus hirae)	66	48	1245
106	14	13576	14253	gi 40027	homologous to E.coli gidB (Bacillus subtilis)	66	52	678
107	3	965	1864	gi 144858	ORF A (Clostridium perfringens)	66	49	900
112	7	5718	6593	gi 609332	DprA (Haemophilus influenzae)	66	43	876
115	1	3	302	gi 727367	Hyr1p (Saccharomyces cerevisiae)	66	56	300
122	1	3	566	gnl pid d101328	Vqiy (Bacillus subtilis)	66	36	564
126	8	11759	11046	gnl pid d101163	ORF3 (Bacillus subtilis)	66	48	714
128	11	8201	8431	gi 726288	growth associated protein GAP-43 (Xenopus laevis)	66	41	231
131	8	4894	4508	gi 486661	THm related protein (Saccharomyces cerevisiae)	66	39	387
140	3	3236	2574	gi 40056	phoP gene product (Bacillus subtilis)	66	36	663
140	15	16318	15434	gi 1658189	5,10-methylenetetrahydrofolate reductase (Erwinia carotovora)	66	48	885
146	12	7926	7636	gnl pid d101140	transposase (Synechocystis sp.)	66	42	291
147	6	7137	6154	gi 472326	TPP-dependent acetoin dehydrogenase alpha-subunit (Clostridium magnum)	66	48	984
149	6	4435	5430	gnl pid d101887	pentose-5-phosphate-3-epimerase (Synechocystis sp.)	66	46	996
149	13	10754	11575	gi 42371	pyruvate formate-lyase activating enzyme (AA 1-246) [Escherichia coli]	66	42	822
186	4	2578	2270	gnl pid d101199	ORF11 (Enterococcus faecalis)	66	41	309
207	2	2340	2597	gnl pid e321893	envelope glycoprotein gp160 (Human immunodeficiency virus type 1)	66	46	258
210	7	3358	3678	gi 49318	ORF4 gene product (Bacillus subtilis)	66	46	321
217	8	5143	5355	gi 49538	thrombin receptor (Cricetulus longicaudatus)	66	38	213
220	4	3875	3642	gi 466648	alternate name ORF6 of L23635 [Escherichia coli]	66	33	234

TABLE 2  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
223	1	1070	138	gml PFD e247187	zinc finger protein [Bacteriophage phigle]	66	45	933
224	2	1864	2640	gml 1176399	putative ABC transporter subunit [Staphylococcus epidermidis]	66	41	777
243	1	3	872	dbj AB000617.2	(AB000617) YcdH [Bacillus subtilis]	66	45	870
268	2	891	568	gml 1517210	putative transposase [Streptococcus pyogenes]	66	60	324
322	1	2	643	gml 1499836	Zn protease [Methanococcus jannaschii]	66	40	642
5	10	13909	13178	gml 1574292	hypothetical [Haemophilus influenzae]	65	34	732
6	11	10465	11190	gml 142854	homologous to E. coli radC gene product and to unidentified protein from Staphylococcus aureus [Bacillus subtilis]	65	48	726
7	2	647	405	pir C64146 C641	hypothetical protein HI0259 - Haemophilus influenzae (strain Rd KW20)	65	42	243
7	7	6246	6821	gml PFD d101323	Yqhu [Bacillus subtilis]	65	50	576
10	2	1873	1397	gml 1163111	ORF-1 [Streptococcus pneumoniae]	65	54	477
16	3	1428	2222	gml PFD e325010	hypothetical protein [Bacillus subtilis]	65	45	795
21	4	3815	3357	gml PFD e314910	hypothetical protein [Staphylococcus scuri]	65	40	459
22	34	25776	26384	gml 1123030	CpxA [Actinobacillus pleuropneumoniae]	65	42	609
43	2	1648	290	gml 1044826	F14E5.1 [Caenorhabditis elegans]	65	38	1359
48	13	10062	10856	gml 1573390	hypothetical [Haemophilus influenzae]	65	45	795
48	22	17521	16883	gml 1573391	hypothetical [Haemophilus influenzae]	65	37	639
48	25	19027	18533	gml PFD e264484	YCR020C, len:215 [Saccharomyces cerevisiae]	65	38	495
49	3	3856	5334	gml 1480429	putative transcriptional regulator [Bacillus stearothermophilus]	65	32	1479
50	6	5337	4519	gml 171963	tRNA isopentenyl transferase [Saccharomyces cerevisiae]	65	42	819
52	15	14728	15588	gml 1499745	M. jannaschii predicted coding region M70912 [Methanococcus jannaschii]	65	46	861
59	7	3963	4745	gml 496514	orf zeta [Streptococcus pyogenes]	65	42	783
68	3	2500	3483	gml 887824	ORF_0310 [Escherichia coli]	65	46	984
69	3	2171	1077	gml PFD e311453	unknown [Bacillus subtilis]	65	42	1095
69	7	6029	5325	gml 809660	deoxyribose-phosphate aldolase [Bacillus subtilis]	65	55	705
71	5	8536	9783	gml 1573224	glycosyl transferase lgtC (GP:U14554_6) [Haemophilus influenzae]	65	42	1248
72	8	7664	8527	gml PFD e267589	Unknown, highly similar to several spermidine synthases [Bacillus subtilis]	65	39	864

TABLE 2

S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
76	5	5773	4097	gnl pid d101723	DNA REPAIR PROTEIN REC N (RECOMBINATION PROTEIN N). [Escherichia coli]	65	44	1677
76	9	8099	7875	gi 1574276	exodeoxyribonuclease, small subunit (xseB) [Haemophilus influenzae]	65	38	225
84	2	2870	2352	gi 2313188	[AE000532] conserved hypothetical protein [Helicobacter pylori]	65	41	519
86	15	14495	13407	gnl pid d101080	3-dehydroquinate synthase [Synecocystis sp.]	65	44	1089
87	3	3706	2433	gi 151259	HMG-CoA reductase (EC 1.1.1.88) [Pseudomonas mevalonii]	65	51	1284
88	3	2425	2736	gi 1098510	unknown [Lactococcus lactis]	65	30	312
89	2	1627	1007	gnl pid d102008	[AB001488] SIMILAR TO ORF14 OF ENTEROCOCCUS FAECALIS TRANSPOSON TN916. [Bacillus subtilis]	65	41	621
111	6	6635	6186	gnl pid e246063	NH21/nucleoside diphosphate kinase [Xenopus laevis]	65	50	450
116	1	3	1016	gnl pid d101125	guanosine biosynthesis protein QueA [Synecocystis sp.]	65	44	1014
123	1	69	389	gi 498839	[ORF2] [Clostridium parfringens]	65	36	321
123	7	6522	7190	gi 1575577	DNA-binding response regulator [Thermotoga maritima]	65	39	669
125	3	3821	2859	gnl pid e257609	sugar-binding transport protein [Anserocellum thermophilum]	65	47	963
137	12	8015	7818	gi 2182574	[AE000090] Y4pE [Rhizobium sp. NGR234]	65	41	198
147	4	5021	3885	gi 472329	dihydrolipoamide acetyltransferase [Clostridium magnum]	65	47	1137
148	2	1053	1931	gnl pid d101319	YqgH [Bacillus subtilis]	65	42	879
151	2	3212	4687	gi 304897	EcoE type I restriction modification enzyme M subunit [Escherichia coli]	65	50	1476
156	2	730	437	gi 310893	membrane protein [Theileria parva]	65	47	294
164	7	4256	4837	gi 410132	[ORF48] [Bacillus subtilis]	65	48	582
169	6	3192	3914	gi 1552737	similar to purine nucleoside phosphorylase (deoB) [Escherichia coli]	65	41	723
176	4	2951	2220	gnl pid e339500	oligopeptide binding lipoprotein [Streptococcus pneumoniae]	65	43	732
195	4	4556	3900	gi 1592142	ABC transporter, probable ATP-binding subunit [Methanococcus jannaschii]	65	40	657
196	1	160	1572	gnl pid d102004	[AB001488] PROBABLE UDP-N-ACETYLURACIL-5-GLUTAMYL-2, 6-DIAMINOLIGASE (EC 6.3.2.15). [Bacillus subtilis]	65	51	1413
204	2	2246	1215	gi 143156	membrane bound protein [Bacillus subtilis]	65	37	1032
210	4	1544	1891	gi 49315	[ORF1] gene product [Bacillus subtilis]	65	48	348
242	2	1625	723	gi 1787540	[AE000226] f249; This 249 aa orf is 32 pct identical (8 gaps) to 244 residues of an approx. 272 aa protein AGAR_ECOLI SM: P42502 [Escherichia coli]	65	42	903



TABLE 2

S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
284	1	1	900	gi 559861	clm [Plasmid pAD1]	65	36	900
304	1	2	574	gnl PID e290934	unknown [Mycobacterium tuberculosis]	65	52	573
315	1	2	1483	gi 730694	mannotan C-5-epimerase (Azotobacter vinelandii)	65	57	1482
320	1	3	569	gnl PID d102048	K. aerogenes, histidine utilization repressor; p12380 (199) DNA binding [Bacillus subtilis]	65	46	567
358	1	1	309	gnl PID e23508	Y105 protein [Bacillus subtilis]	65	55	309
2	7	7571	6696	gi 1498753	nicotinate-nucleotide pyrophosphorylase [Rhodospirillum rubrum]	64	47	876
6	6	5924	6802	gnl PID d101111	methionine aminopeptidase (Synechocystis sp.)	64	52	879
8	4	3417	3686	gi 1045935	DNA helicase II (Mycoplasma genitalium)	64	58	270
11	4	3249	2689	gnl PID e265529	OrfB [Streptococcus pneumoniae]	64	46	561
15	7	6504	7145	gi 1762328	Yer59c/YigZ homolog [Bacillus subtilis]	64	45	642
22	11	9548	9895	gnl PID d100581	unknown [Bacillus subtilis]	64	38	348
22	30	22503	23174	gi 289260	comE ORF1 [Bacillus subtilis]	64	44	672
26	7	14375	14199	gi 409286	barU [Bacillus subtilis]	64	30	177
27	2	1510	1334	gi 40795	DdeI methylase (Desulfovibrio vulgaris)	64	51	177
29	2	614	297	gi 2326168	type VII collagen [Mus musculus]	64	50	318
35	2	368	721	pir JCL151 JCL1	hypothetical 20.3K protein (insertion sequence IS1131) - Agrobacterium tumefaciens (strain P022) plasmid T1	64	50	354
40	1	3	449	gi 46970	epiD gene product (Staphylococcus epidermidis)	64	41	447
40	7	4683	4976	gnl PID e325792	(AJ000005) glucose kinase [Bacillus megaterium]	64	45	294
45	7	8068	6920	gnl PID d102036	subunit of ADP-glucose pyrophosphorylase [Bacillus stearothermophilus]	64	40	1149
51	2	301	1059	gi 43985	nifs-like gene [Lactobacillus delbrueckii]	64	54	759
51	13	15251	18397	gi 2293260	(AF008220) DNA-polymerase III alpha-chain [Bacillus subtilis]	64	46	3147
53	3	1157	555	gi 1574292	hypothetical [Haemophilus influenzae]	64	47	603
58	2	4236	1606	gi 1571826	alanyl-tRNA synthetase (alaS) [Haemophilus influenzae]	64	51	2631
66	1	3	1259	gi 895749	putative cellobiose phosphotransferase enzyme II' [Bacillus subtilis]	64	42	1257
68	5	5213	6556	gi 436965	(maia) gene products [Bacillus stearothermophilus]	64	47	1344
69	6	5356	4949	gnl PID d101316	Cdd [Bacillus subtilis]	64	52	408

**TABLE 2**  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	Match accession	Match gene name	% sim	% ident	Length (nt)
74	4	6948	5038	gi 726480	L-glutamine-D-fructose-6-phosphate amidotransferase [Bacillus subtilis]	64	50	1911
75	3	1283	1465	bbs 13379	TLS-CHOP-fusion protein(CHOP-C/EBP transcription factor, TLS-nuclear RNA-binding protein) [human, myxoid liposarcoma cells, Peptide Mutant, 462 aa] [Homo sapiens]	64	57	183
81	13	14016	14231	gi 143175	methanol dehydrogenase alpha-10 subunit [Bacillus sp.]	64	35	216
83	22	21851	22090	gml PID d101315	YqfA [Bacillus subtilis]	64	44	240
87	11	10046	9300	gml PID e323505	putative Pci protein [Bacillus subtilis]	64	43	747
98	7	5032	5706	gml PID e233880	hypothetical protein [Bacillus subtilis]	64	38	675
105	1	2	1276	gi 1657503	similar to S. aureus mercury(II) reductase [Escherichia coli]	64	45	1275
113	7	5136	6410	gml PID d101119	Nifs [Synechocystis sp.]	64	50	1275
119	1	2	1297	gml PID e320520	hypothetical protein [Naionobacterium pharaonis]	64	37	1296
123	3	1125	2156	gml PID e253284	ORF YD244w [Saccharomyces cerevisiae]	64	40	1032
124	5	2331	1780	gml PID d101884	hypothetical protein [Synechocystis sp.]	64	50	552
129	4	3467	2709	gml PID d101314	Yqeu [Bacillus subtilis]	64	52	759
131	1	152	3	gi 1377841	unknown [Bacillus subtilis]	64	42	150
137	11	7196	7549	pir JC1151 JC11	hypothetical 20.3K protein (insertion sequence IS1131) - Agrobacterium tumefaciens (strain P022) plasmid T1	64	50	354
139	3	3226	2651	gi 2293301	(AF008220) Ytqb [Bacillus subtilis]	64	44	576
146	10	6730	5648	gi 1322245	mevalonate pyrophosphate decarboxylase [Rattus norvegicus]	64	45	1083
147	1	2	1018	gml PID e137033	unknown gene product [Lactobacillus leichmannii]	64	46	1017
148	11	8430	8783	gi 2130630	(AF000430) dynamin-like protein [Homo sapiens]	64	28	354
156	7	4313	3612	gml PID d102050	transmembrane [Bacillus subtilis]	64	31	702
157	4	1299	2114	gml PID d100892	homologous to Gln transport system permease proteins [Bacillus subtilis]	64	43	816
162	6	5880	6362	gi 517204	ORF1, putative 42 kDa protein [Streptococcus pyogenes]	64	58	483
164	13	9707	8769	gml PID d100964	homologue of ferric anguibactin transport system permease protein FatD of V. anguillarum [Bacillus subtilis]	64	40	939
175	5	3906	4598	gi 534045	antiterminator [Bacillus subtilis]	64	39	693
189	10	6154	6507	gi 581307	response regulator [Lactobacillus plantarum]	64	33	354
191	4	3519	2863	gi 149520	phosphoribosyl anthranilate isomerase [Lactococcus lactis]	64	46	657

TABLE 2  
S. pneumoniae - Putative coding regions of novel proteins' similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
202	1	76	1140	gnl PID e293806	O-acetylhomoserine sulphydrolase [Leptospira meyeri]	64	47	1065
224	1	234	1571	gi 1573393	collagenase (prtc) [Haemophilus influenzae]	64	42	1338
231	3	291	647	gi 40174	ORF X [Bacillus subtilis]	64	43	357
253	3	709	1089	pir JC1151 JC11	hypothetical 20.3K protein (insertion sequence IS1131) - Agrobacterium tumefaciens (strain P022) plasmid Ti	64	50	381
265	1	820	2	gi 1377832	unknown [Bacillus subtilis]	64	31	819
297	1	1	660	gi 1590871	collagenase [Methanococcus jannaschii]	64	48	660
328	1	263	21	gi 992651	Glnp [Saccharomyces cerevisiae]	64	41	243
5	4	8730	8098	gi 556885	unknown [Bacillus subtilis]	63	48	633
10	6	5178	4483	gi 1573101	hypothetical [Haemophilus influenzae]	63	40	696
12	11	9124	9902	gi 806536	membrane protein [Bacillus acidopulluliticus]	63	42	579
15	10	8897	9187	gi 722339	unknown [Acetobacter xylinum]	63	40	291
17	2	1031	309	gnl PID e217602	PlnU [Lactobacillus plantarum]	63	32	723
18	8	7778	6975	gi 1377843	unknown [Bacillus subtilis]	63	45	804
26	4	9780	7078	gi 142440	ATP-dependent nuclease [Bacillus subtilis]	63	46	2703
29	5	3488	4192	gi 1377829	unknown [Bacillus subtilis]	63	35	705
34	11	8830	7988	gnl PID d101198	ORF8 [Enterococcus faecalis]	63	45	843
35	3	1187	876	gi 722339	unknown [Acetobacter xylinum]	63	39	312
48	15	12509	11691	gi 1573389	hypothetical [Haemophilus influenzae]	63	41	819
51	11	12719	12189	gi 142450	ahrC protein [Bacillus subtilis]	63	35	531
55	4	3979	5022	gi 1708640	YeaB [Bacillus subtilis]	63	41	1044
55	15	13669	114670	gnl PID e311502	thioredoxine reductase [Bacillus subtilis]	63	44	1002
68	10	9242	8919	sp P37686 YIAY_	HYPOTHETICAL 40.2 KD PROTEIN IN AVTA-SELB INTERGENIC REGION (F382).	63	40	324
86	7	6554	5685	gi 1574382	lhc-1 operon protein (lhcD) [Haemophilus influenzae]	63	41	870
88	8	6085	5180	gi 2098719	putative fibrillar-associated protein [Actinomyces naeslundii]	63	43	906
96	8	5858	6484	gi 1052803	orf19rb gene product [Streptococcus pneumoniae]	63	38	627
100	1	240	1940	gi 17171	flucosidase [Dictyostelium discoideum]	63	36	1701

TABLE 2  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
104	4	3063	5765	gi 1444985	phosphoenolpyruvate carboxylase [Corynebacterium glutamicum]	63	46	2703
106	8	9189	8554	gi 533099	endonuclease III [Bacillus subtilis]	63	45	636
122	6	4704	4886	gnl pid d101139	transposase [Synechocystis sp.]	63	39	183
128	7	4517	5203	gnl pid d101434	orf2 [Methanobacterium thermautotrophicum]	63	50	687
137	4	963	1547	gi 472920	v-type Na-ATPase [Enterococcus hirae]	63	27	585
142	7	4100	4595	gnl pid e313025	hypothetical protein [Bacillus subtilis]	63	44	486
159	5	1741	2571	gi 1787043	[AE000184] f271; This 271 aa orf is 24 pct identical (16 gaps) to 265 residues of an approx. 272 aa protein YIDA_EC011 SW: P09997 [Escherichia coli]	63	39	831
171	12	8803	14406	gnl pid e324918	IgA1 protease [Streptococcus sanguis]	63	48	5604
177	1	3	347	gi 1773150	hypothetical 14.8kd protein [Escherichia coli]	63	34	345
178	2	423	917	gi 722339	unknown [Acetobacter xylinum]	63	41	495
178	3	794	1012	gi 1591582	cobalamin biosynthesis protein N [Methanococcus jannaschii]	63	36	219
195	1	1377	175	gnl pid e324217	ftsQ [Enterococcus hirae]	63	33	1203
234	5	1739	1527	gi 1591582	cobalamin biosynthesis protein N [Methanococcus jannaschii]	63	36	213
249	1	81	257	gi 1000453	TreR [Bacillus subtilis]	63	41	177
283	1	127	1347	gi 396486	ORF8 [Bacillus subtilis]	63	44	1221
293	3	2804	3466	gi 722339	unknown [Acetobacter xylinum]	63	37	663
311	1	905	486	gi 1877424	UDP-galactose 4-epimerase [Streptococcus mutans]	63	46	420
324	1	2	556	gi 1477741	histidine periplasmic binding protein P29 [Campylobacter jejuni]	63	36	555
365	1	219	13	gi 2252843	[AF013293] No definition line found [Arabidopsis thaliana]	63	33	207
382	1	88	378	gi 722339	unknown [Acetobacter xylinum]	63	40	291
385	3	364	158	gi 2252843	[AF013293] No definition line found [Arabidopsis thaliana]	63	33	207
2	1	2495	288	gnl pid e325007	penicillin-binding protein [Bacillus subtilis]	62	42	2208
3	23	23374	24231	gnl pid e254993	hypothetical protein [Bacillus subtilis]	62	35	858
6	16	14320	13193	gnl pid e349614	nifs-like protein [Mycobacterium leprae]	62	37	1128
7	8	6819	7232	gnl pid d101324	Yqhy [Bacillus subtilis]	62	32	414
7	19	15466	14207	gnl pid d101804	beta ketoacyl-acyl carrier protein synthase [Synechocystis sp.]	62	43	1260

TABLE 2  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
7	21	17155	16229	gnl pid e323514	putative FabD protein [Bacillus subtilis]	62	46	927
7	24	19526	18519	gi 1276434	beta-ketocyl-ACP synthase III [Cuphea wrightii]	62	37	1008
12	7	5904	4702	gi 1573768	A/G-specific adenine glycosylase (mutY) [Haemophilus influenzae]	62	43	1203
12	9	8032	8793	gi 1591587	pantothenate metabolism flavoprotein [Methanococcus jannaschii]	62	33	762
15	11	9678	9328	pir JC1151 JC11	hypothetical 20.3K protein (insertion sequence IS1131) - Agrobacterium tumefaciens (strain P022) plasmid T4	62	43	351
17	4	2609	2442	gi 1591081	M. jannaschii predicted coding region MJ0374 (Methanococcus jannaschii)	62	43	168
17	5	3053	2835	gi 149570	role in the expression of lactacin F, part of the lac operon [Lactobacillus sp.]	62	44	219
22	10	8627	9538	gnl pid d100580	similar to B. subtilis DnaH [Bacillus subtilis]	62	43	912
30	3	865	2043	gi 2314379	[AE000627] ABC transporter, ATP-binding protein (yhcg) [Helicobacter pylori]	62	43	1179
33	5	2235	1636	gi 413976	lpa-52r gene product [Bacillus subtilis]	62	44	600
38	11	5689	6123	gi 148231	6251 [Escherichia coli]	62	34	435
40	17	14272	13328	gnl pid d101904	hypothetical protein [Synecocystis sp.]	62	43	945
42	1	3	311	gi 1146182	putative [Bacillus subtilis]	62	41	309
44	2	1267	4005	gi 1786952	[AE000176] 0877; 100 pct identical to the first 86 residues of the 100 aa hypothetical protein fragment YBGB_ECOLI SW: P54746 [Escherichia coli]	62	43	2739
48	12	9732	9304	gi 562920	repressor protein [Enterococcus hirae]	62	32	429
51	8	5664	7181	gnl pid e301153	StySKI methylase [Salmonella enterica]	62	44	1518
52	3	2791	2099	gi 1183886	integral membrane protein [Bacillus subtilis]	62	41	693
55	16	15702	14704	gnl pid e313028	hypothetical protein [Bacillus subtilis]	62	40	999
59	6	3418	3984	gi 2065483	unknown [Lactococcus lactis lactis]	62	32	567
63	5	4997	4809	gi 149771	pinin gene inverting protein (pivML) [Moraxella lacunata]	62	28	189
70	14	10002	10739	gi 992977	bplG gene product [Bordetella pertussis]	62	45	738
71	13	18790	20382	gi 1280135	coded for by C. elegans cDNA cm2166; coded for by C. elegans cDNA cm0162; similar to melibiose carrier protein (thiomethylgalactoside permease II) [Caenorhabditis elegans]	62	62	1593
71	28	32217	32768	gnl pid d101312	VqeG [Bacillus subtilis]	62	35	552
74	7	11666	10383	gi 1552753	hypothetical [Escherichia coli]	62	38	1284

TABLE 2

S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
80	8	9370	9609	[gnl PID d102002]	(AB001488) FUNCTION UNKNOWN. [Bacillus subtilis]	62	46	240
97	10	9068	7041	[gi 882463]	protein-N(pil)-phosphohistidine-sugar phosphotransferase [Escherichia coli]	62	42	2028
98	4	2306	3268	[gnl PID d101496]	[BraE (integral membrane protein) [Pseudomonas aeruginosa]	62	42	963
102	3	2823	3539	[gnl PID e313010]	hypothetical protein [Bacillus subtilis]	62	24	717
103	3	2795	1242	[gnl PID d102049]	H. influenzae hypothetical ABC transporter; P44808 (974) [Bacillus subtilis]	62	41	1554
111	2	2035	3462	[gi 581297]	NisP [Lactococcus lactis]	62	44	1428
112	4	3154	4080	[gi 1574379]	lilc-1 operon protein (lilcA) [Haemophilus influenzae]	62	39	927
112	6	4939	5649	[gi 1574381]	lilc-1 operon protein (lilcC) [Haemophilus influenzae]	62	39	711
124	3	1137	721	[gi 1573024]	anaerobic ribonucleoside-triphosphate reductase (nrtd) [Haemophilus influenzae]	62	45	417
124	6	3162	2329	[gi 609076]	leucyl aminopeptidase [Lactobacillus delbrueckii]	62	40	834
126	7	11073	7516	[gnl PID d101163]	ORF4 [Bacillus subtilis]	62	38	3558
129	6	4983	4540	[pic S41509 S415]	zinc finger protein EF6 - Chilo iridescent virus	62	48	444
131	7	4510	4103	[gi 1857245]	unknown [Lactococcus lactis]	62	42	408
149	2	1923	2579	[gi 1592142]	ABC transporter, probable ATP-binding subunit [Methanococcus jannaschii]	62	41	657
149	7	5360	6055	[gnl PID e323508]	YioS protein [Bacillus subtilis]	62	40	696
156	1	450	238	[gnl PID e254644]	membrane protein [Streptococcus pneumoniae]	62	40	213
156	6	3606	2935	[gnl PID d102050]	transmembrane [Bacillus subtilis]	62	37	672
171	2	1779	2291	[gi 43941]	ETII-B Sor PTS [Klebsiella pneumoniae]	62	35	513
172	2	385	723	[gi 895750]	putative cellobiose phosphotransferase enzyme III [Bacillus subtilis]	62	39	339
173	3	2599	893	[gi 1591732]	cobalt transport ATP-binding protein O [Methanococcus jannaschii]	62	42	1707
179	2	492	1754	[gi 1574071]	H. influenzae predicted coding region H1038 [Haemophilus influenzae]	62	38	1263
181	6	2856	3707	[gi 1777435]	Lact [Lactobacillus casei]	62	42	852
185	2	2074	311	[gi 12482397]	(AE000073) Y4FN [Rhizobium sp. NGR234]	62	41	1764
200	2	1061	1984	[gi 450566]	transmembrane protein [Bacillus subtilis]	62	37	924
202	3	2583	3473	[gi 42219]	P35 gene product (AA 1 - 314) [Escherichia coli]	62	41	891
210	3	1374	1565	[gi 49315]	ORF1 gene product [Bacillus subtilis]	62	45	192

TABLE 2  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
211	1	3	971	gi 147402	mannose permease subunit III-Man [Escherichia coli]	62	43	969
223	2	1495	1034	gnl pid d101190	ORF2 [Streptococcus mutans]	62	41	462
228	1	34	909	gi 530063	glycerol uptake facilitator [Streptococcus pneumoniae]	62	44	876
234	2	90	917	gi 2293259	[AF008220] Ycqi [Bacillus subtilis]	62	38	828
282	5	1765	1487	gnl pid e276475	galactokinase [Arabidopsis thaliana]	62	33	279
375	1	1	159	gi 1674231	[AE000052] Mycoplasma pneumoniae, hypothetical protein homolog; similar to Swiss-Prot Accession Number P35155, from B. subtilis [Mycoplasma pneumoniae]	62	40	159
385	5	584	357	gi 1573353	outer membrane integrity protein (tolA) [Haemophilus influenzae]	62	47	228
3	19	18550	19289	gi 606162	ORF_f229 [Escherichia coli]	61	41	720
7	4	2725	3225	gi 2114425	similar to Synecocystis sp. hypothetical protein, encoded by GenBank Accession Number D64006 [Bacillus subtilis]	61	42	501
17	6	3326	3054	gi 149569	lactacin F [Lactobacillus sp.]	61	43	273
44	3	4061	4957	gnl pid d101068	xylose repressor [Synecocystis sp.]	61	38	897
54	11	8388	7234	gnl pid d101329	YqjH [Bacillus subtilis]	61	42	1155
57	6	3974	6037	gnl pid d101316	YqfK [Bacillus subtilis]	61	42	2064
58	5	7356	6565	sp P45169 POTC_	SPERMIDINE/PUTRESCINE TRANSPORT SYSTEM PERMEASE PROTEIN POTC.	61	34	792
67	1	3	692	gi 537108	ORF_f254 [Escherichia coli]	61	46	690
68	9	8816	7890	gi 19501	pPL212 gene product (AA 1-184) [Lupinus polyphyllus]	61	41	927
70	15	10737	12008	gi 992976	bplF gene product [Bordetella pertussis]	61	44	1272
72	11	9759	10202	gnl pid d101833	carboxymorspermidine decarboxylase [Synecocystis sp.]	61	36	444
76	8	7881	7003	gnl pid d100305	farnesyl diphosphate synthase [Bacillus stearothermophilus]	61	45	879
87	4	4914	3697	gi 528991	unknown [Bacillus subtilis]	61	42	1218
87	13	12311	11361	gi 1789683	[AE000407] methionyl-tRNA formyltransferase [Escherichia coli]	61	44	951
91	2	731	2989	gi 537080	ribonucleoside triphosphate reductase [Escherichia coli]	61	45	2259
105	3	2711	3499	gnl pid d101851	hypothetical protein [Synecocystis sp.]	61	44	789
115	6	7968	6478	gi 895747	putative cel operon regulator [Bacillus subtilis]	61	36	1491
123	8	7181	8518	gi 1209527	protein histidine kinase [Enterococcus faecalis]	61	40	1338

**TABLE 2**  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
126	6	7525	6725	gi 11787043	(AE00184) f271; This 271 aa orf is 24 pct identical (16 gaps) to 265 residues of an approx. 272 aa protein YIDA_ECOLI SW: P09997 [Escherichia coli]	61	38	801
128	1	1	639	gnl pid d101328	YqjY [Bacillus subtilis]	61	41	639
139	7	4794	5054	gi 1022726	unknown [Staphylococcus haemolyticus]	61	41	261
139	9	12632	5913	gnl pid e270014	beta-galactosidase [Thermotoga thermophilus]	61	41	6720
143	1	2552	42	gi 520541	penicillin-binding proteins 1A and 1B [Bacillus subtilis]	61	42	2511
148	16	12125	11424	gi 1552743	tetrahydronicotinamide N-succinyltransferase [Escherichia coli]	61	42	702
162	3	4112	3456	gnl pid d101829	phosphoglycolate phosphatase [Synechocystis sp.]	61	30	657
172	3	727	1077	gnl pid d102048	B. subtilis, cellobiose phosphotransferase system, celsA; P46318 (220) [Bacillus subtilis]	61	44	351
177	3	1101	1772	gnl pid d100574	unknown [Bacillus subtilis]	61	43	672
202	2	1278	2585	gi 1045831	hypothetical protein (GB:U8965_6) [Mycoplasma genitalium]	61	36	1308
224	3	2782	3144	gi 1591144	M. Jannaschii predicted coding region M0440 [Methanococcus jannaschii]	61	30	363
225	4	3395	3766	gi 1552774	hypothetical [Escherichia coli]	61	40	372
249	2	212	802	gi 1000453	Trer [Bacillus subtilis]	61	42	591
254	2	843	484	gnl pid d100417	ORF120 [Escherichia coli]	61	36	360
257	1	3	350	gnl pid e255315	unknown [Mycobacterium tuberculosis]	61	42	348
293	4	3971	3657	pir JC1151 JC11	hypothetical 20.3K protein (insertion sequence IS1131) - Agrobacterium tumefaciens (strain P022) plasmid T1	61	45	315
301	1	949	17	gi 2291209	[AF016424] contains similarity to acyltransferases [Caenorhabditis elegans]	61	33	933
373	1	1066	287	gi 393396	Tb-292 membrane associated protein [Trypanosoma brucei subgroup]	61	38	780
3	24	24473	24955	gi 537093	ORF_0153b [Escherichia coli]	60	27	483
6	5	4636	5739	gi 2293258	[AF008220] YcoI [Bacillus subtilis]	60	35	1104
6	12	11936	11187	gi 293017	ORF3 (put.); putative [Lactococcus lactis]	60	44	750
17	13	6708	6484	gi 149569	Lactacin F [Lactobacillus sp.]	60	32	225
18	7	6977	5670	gi 1788140	(AE000278) o481; This 481 aa orf is 35 pct identical (19 gaps) to 309 residues of an approx. 856 aa protein NOL1_HUMAN SW: P46087 [Escherichia coli]	60	43	1308
20	15	15878	17167	gnl pid d100584	unknown [Bacillus subtilis]	60	44	1290



TABLE 2  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
22	1	1	243	[gnl PID d102050]	transmembrane (Bacillus subtilis)	60	36	243
32	10	8296	8964	[gnl 2293275]	[AF008220] YtaG (Bacillus subtilis)	60	37	669
38	15	8837	9697	[gnl 40023]	18 subtilis genes rpmH, rpmA, 50kd, gidA and gidB (Bacillus subtilis)	60	35	861
43	6	8610	5944	[gnl 171787]	protein kinase 1 (Saccharomyces cerevisiae)	60	36	2667
44	1	1	1269	[gnl PID e235823]	unknown (Schizosaccharomyces pombe)	60	44	1269
45	10	11138	10368	[gnl 397488]	1,4-alpha-glucan branching enzyme (Bacillus subtilis)	60	43	771
48	19	15766	14378	[gnl PID e205173]	[orf1] (Lactobacillus helveticus)	60	39	1389
48	21	16727	16951	[gnl PID d102041]	[AB002668] unnamed protein product (Haemophilus actinomycetemcomitans)	60	32	225
50	1	2	898	[gnl PID e246537]	ORF286 protein (Pseudomonas stutzeri)	60	31	897
62	2	638	1177	[gnl PID d100587]	unknown (Bacillus subtilis)	60	42	540
68	4	3590	5203	[gnl 1573583]	H. influenzae predicted coding region H10594 (Haemophilus influenzae)	60	36	1614
70	11	5781	6182	[gnl PID d102014]	[AB001488] SIMILAR TO YDFR GENE PRODUCT OF THIS ENTRY (YDFR_BACSU). (Bacillus subtilis)	60	33	402
70	12	6343	8133	[gnl PID e324970]	hypothetical protein (Bacillus subtilis)	60	38	1791
71	8	11701	14157	[gnl 580866]	lipa-12d gene product (Bacillus subtilis)	60	33	2457
74	8	12509	11664	[gnl PID d101832]	phosphatidate cytidyltransferase (Synechocystis sp.)	60	45	846
76	4	4116	3367	[gnl 2352096]	[orf; similar to serine/threonine protein phosphatase (Fervidobacterium islandicum)]	60	39	750
80	4	7372	7665	[gnl 1786420]	[AE000131] f86; 100 pct identical to GB: ECODINJ_6 ACCESSION: D38582 (Escherichia coli)	60	30	294
81	6	4073	4522	[gnl 147402]	[mannose permease subunit III-Man (Escherichia coli)]	60	35	450
86	1	940	155	[gnl 143177]	[putative (Bacillus subtilis)]	60	26	786
92	1	1	192	[gnl 396348]	[homoserine transuccinylase (Escherichia coli)]	60	45	192
93	14	10619	9384	[gnl 1788389]	[AE000297] o464; This 464 aa orf is 33 pct identical (9 gaps) to 331 residues of an approx. 416 aa protein MTRC_NEIGO SW: P43505 (Escherichia coli)	60	27	1236
94	5	5548	8121	[gnl PID e329895]	[AJ000496] cyclic nucleotide-gated channel beta subunit (Rattus norvegicus)	60	50	2574
97	7	5396	4533	[gnl 1591396]	[transketolase (Methanococcus jannaschii)]	60	43	864
102	2	2081	2833	[gnl PID e320929]	[hypothetical protein (Mycobacterium tuberculosis)]	60	43	753

**TABLE 2**  
*S. pneumoniae* - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
106	9	9773	9183	[gnl PID e334782]	WibN protein [Bacillus subtilis]	60	31	591
113	8	6361	6837	[gi 466875]	[nifU; B1496_C1_157 (Mycobacterium leprae)]	60	43	477
115	2	2755	524	[gnl PID e328143]	[AJ000332] Glucosidase II (Homo sapiens)	60	32	2232
122	7	4763	5068	[gnl PID d101876]	[transposase (Synecocystis sp.)]	60	39	306
127	8	4510	5283	[gi 1777938]	[Pgm (Treponema pallidum)]	60	38	774
138	4	3082	2672	[gnl PID e325196]	[hypothetical protein (Bacillus subtilis)]	60	36	411
139	1	177	4	[gnl PID d100680]	[ORF (Thermus thermophilus)]	60	39	174
139	11	14520	13009	[gi 537145]	[ORF_F437 (Escherichia coli)]	60	30	1512
140	2	2592	1249	[gi 1209527]	[protein histidine kinase (Enterococcus faecalis)]	60	37	1344
141	1	210	1049	[gi 463181]	[E5 ORF from bp 3842 to 4081; putative (Human papillomavirus type 33)]	60	34	840
141	5	5368	6405	[gi 145362]	[tyrosine-sensitive DAHP synthase (aroF) (Escherichia coli)]	60	41	1038
142	6	3558	4049	[gi 600711]	[putative (Bacillus subtilis)]	60	37	492
148	10	7742	8713	[gnl PID e313022]	[hypothetical protein (Bacillus subtilis)]	60	27	972
153	5	3667	4278	[gi 2293322]	[AF008220] branch-chain amino acid transporter (Bacillus subtilis)	60	42	612
155	1	1413	748	[gi 2104504]	[putative UDP-glucose dehydrogenase (Escherichia coli)]	60	40	666
158	3	3116	2472	[gnl PID d100872]	[a negative regulator of pho regulon (Pseudomonas aeruginosa)]	60	37	645
159	3	778	1386	[gnl PID e308090]	[product highly similar to Bacillus anthracis CapA protein (Bacillus subtilis)]	60	48	609
163	7	8049	8468	[gnl PID d101313]	[yqen (Bacillus subtilis)]	60	38	420
170	3	4130	2688	[gi 1574179]	[H. influenzae predicted coding region HI1244 (Haemophilus influenzae)]	60	39	1443
171	7	4717	5901	[gi 604076]	[ORF_o384 (Escherichia coli)]	60	44	1185
183	3	2440	2135	[gi 1877427]	[repressor (Streptococcus pyogenes phage T12)]	60	38	306
191	10	9444	8428	[gi 415664]	[catabolite control protein (Bacillus megaterium)]	60	42	1017
200	1	139	1083	[gi 438462]	[transmembrane protein (Bacillus subtilis)]	60	37	945
201	3	3895	1928	[gi 475112]	[enzyme Iiabc (Pedococcus pentosaceus)]	60	39	1968
214	15	10930	10439	[gi 1573407]	[hypothetical (Haemophilus influenzae)]	60	39	492
218	4	2145	2363	[gi 608520]	[myosin heavy chain kinase A (Dictyostelium discoideum)]	60	31	219

TABLE 2

S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
226	4	2518	2351	gi 437705	hyaluronidase (Streptococcus pneumoniae)	60	53	168
242	1	725	3	gi 43938	Sor regulator (Klebsiella pneumoniae)	60	41	723
245	1	1	288	gi 304897	EcoE type I restriction modification enzyme M subunit (Escherichia coli)	60	56	288
251	1	905	45	gi 671632	unknown (Staphylococcus aureus)	60	36	861
259	1	969	82	gi 153794	rgg (Streptococcus gordonii)	60	32	888
260	2	1492	1662	pir S31840 S318	probable transposase - Bacillus stearothermophilus	60	26	171
274	1	836	96	gi 1592173	N-ethylmaleine chlorohydrolase (Methanococcus jannaschii)	60	40	741
308	1	463	2	gi 1787397	(AE000214) o157 (Escherichia coli)	60	43	462
318	1	3	308	gm PID e137594	xerC recombinase (Lactobacillus leichmannii)	60	42	306
344	1	73	522	gi 509672	repressor protein (Bacteriophage Tuc2009)	60	32	450
5	1	576	4	gi 2293147	(AF008220) YtxM (Bacillus subtilis)	59	31	573
7	22	18140	17142	gm PID e280724	unknown (Mycobacterium tuberculosis)	59	39	999
10	1	1413	4	gi 1353880	islatidase L (Mycobacteria decori)	59	41	1410
15	6	6463	5156	gi 580841	F1 (Bacillus subtilis)	59	35	1308
22	2	479	1393	gi 142469	als operon regulatory protein (Bacillus subtilis)	59	34	915
22	5	2698	4614	gm PID e280623	PCPA (Streptococcus pneumoniae)	59	44	1917
30	1	208	558	gm PID e233868	hypothetical protein (Bacillus subtilis)	59	37	351
30	4	3678	2455	gm PID e202290	unknown (Lactobacillus sake)	59	33	1224
35	13	12201	11071	gm PID e238664	hypothetical protein (Bacillus subtilis)	59	35	1131
35	14	13288	12182	gi 1657647	Cep8H (Staphylococcus aureus)	59	39	1107
36	18	18076	17897	gi 1500535	M. jannaschii predicted coding region MJ1635 (Methanococcus jannaschii)	59	33	180
38	12	6172	7137	gi 2293239	(AF008220) YtxK (Bacillus subtilis)	59	34	966
42	3	1952	3361	gi 1684845	pinin (Canis familiaris)	59	40	1410
50	3	2678	1728	gm PID d101329	VqJK (Bacillus subtilis)	59	41	951
56	5	1870	2388	gm PID e137594	xerC recombinase (Lactobacillus leichmannii)	59	41	519
61	6	6812	5628	gm PID e311516	aminotransferase (Bacillus subtilis)	59	40	1185
67	5	2382	3023	gi 1146190	2-keto-3-deoxy-6-phosphogluconate aldolase (Bacillus subtilis)	59	36	642

**TABLE 2**  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
69	10	8567	8899	gi11573628	antheminate kinase (coaA) (Haemophilus influenzae)	59	38	333
87	12	11383	10055	gnlPIDe323504	putative Emu protein (Bacillus subtilis)	59	44	1329
113	14	13927	15894	gi11673731	(AE000010) Mycoplasma pneumoniae, fructose-permease IBC component; similar to Swiss-Prot Accession Number P20966, from E. coli (Mycoplasma pneumoniae)	59	43	1968
115	8	8766	8521	gi11590886	M. jannaschii predicted coding region MJ0110 (Methanococcus jannaschii)	59	38	246
119	2	1966	1526	gnlPIDe209005	homologous to ORF2 in nrdEF operons of E.coli and S.typhimurium (Lactococcus lactis)	59	43	441
128	17	13438	13178	gnlPIDe279632	unknown (Mycobacterium tuberculosis)	59	38	261
140	22	21903	23388	gi1482922	protein with homology to pail repressor of B.subtilis (Lactobacillus delbrueckii)	59	40	516
148	13	9697	9014	gnlPIDd102005	(AB001488) FUNCTION UNKNOWN, SIMILAR PRODUCT IN H. INFLUENZAE AND SYNCHOCYSTIS. (Bacillus subtilis)	59	32	684
149	10	7213	8244	gi1710422	cap-binding-factor 1 (Staphylococcus aureus)	59	40	1032
164	9	6993	6013	gnlPIDd100965	ferric anguibactin-binding protein precursor FatB of V. anguillarum (Bacillus subtilis)	59	41	981
164	12	8836	7823	gnlPIDd100964	homologue of ferric anguibactin transport system permease protein FatC of V. anguillarum (Bacillus subtilis)	59	35	1014
177	2	401	1072	gi1289759	coded for by C. elegans cDNA CE203 (GenBank:214728); putative (Caenorhabditis elegans)	59	40	672
177	7	3841	4200	gi12313445	(AE000551) H. pylori predicted coding region HP0342 (Helicobacter pylori)	59	38	360
183	4	2768	2508	gi1509672	repressor protein (Bacteriophage Tuc2009)	59	50	261
186	6	3398	2820	gi1606080	ORF_0290; Geneplot suggests frameshift linking to o267, not found (Escherichia coli)	59	38	579
190	3	3120	1711	gi11613768	histidine protein kinase (Streptococcus pneumoniae)	59	32	1410
194	2	1621	1019	gnlPIDd100579	unknown (Bacillus subtilis)	59	40	603
198	7	5205	4306	gnlPIDe313073	hypothetical protein (Bacillus subtilis)	59	38	900
220	5	4362	3958	gnlPIDd101322	YqjH (Bacillus subtilis)	59	46	405
242	3	1573	2367	gi11787045	(AE000184) f308; This 308 aa orf is 35 pct identical (35 gaps) to 305 residues of an approx. 296 aa protein PFIC_ECOLI SW: P32675 (Escherichia coli)	59	42	795
247	2	1154	1480	gi140073	ORF107 (Bacillus subtilis)	59	39	327

**TABLE 2**  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
256	1	868	2	gnl PID d101924	hemolysin [Synecocystis sp.]	59	39	867
258	1	65	820	gi 2246532	ORF 73, contains large complex repeat CR 73 (Kaposi's sarcoma-associated herpesvirus)	59	20	756
270	1	386	1126	gnl PID d102092	YfnB [Bacillus subtilis]	59	40	741
281	1	552	166	gi 666062	putative [Lactococcus lactis]	59	31	387
309	1	3	479	gi 405879	yehH [Escherichia coli]	59	38	477
363	1	2	1894	gi 915208	gastric mucin [Sus scrofa]	59	31	1893
387	2	425	84	gi 160671	S antigen precursor [Plasmodium falciparum]	59	44	342
5	6	1123	10465	gnl PID d101812	LumQ [Synecocystis sp.]	58	29	759
29	4	2098	3513	gnl PID d100479	Na <sup>+</sup> -ATPase subunit J [Enterococcus hirae]	58	39	1416
30	5	4058	3651	gi 39478	ATP binding protein of transport ATPases [Bacillus firmus]	58	34	408
33	6	2983	2210	gnl PID d101164	unknown [Bacillus subtilis]	58	45	774
36	8	5316	6179	gi 1518679	orf [Bacillus subtilis]	58	32	864
43	5	5926	3971	gi 1788150	[AE000278] protease II [Escherichia coli]	58	37	1956
46	5	3704	5221	gnl PID e267329	unknown [Bacillus subtilis]	58	42	1518
48	14	11722	11066	gnl PID d101771	thiamin biosynthetic bifunctional enzyme [Synecocystis sp.]	58	34	657
52	1	1229	3	gnl PID d101291	reductase [Pseudomonas aeruginosa]	58	35	1227
53	2	702	412	gi 2313357	[AE000345] cytochrome c biogenesis protein (ccda) [Helicobacter pylori]	58	25	291
58	4	6586	5498	gi 147329	transport protein [Escherichia coli]	58	41	1089
69	5	4934	3807	gnl PID e311492	unknown [Bacillus subtilis]	58	41	1128
71	27	31357	32277	gi 2408014	hypothetical protein [Schizosaccharomyces pombe]	58	33	921
72	4	3586	2882	gi 18694	nodulin-21 (AA 1-201) [Glycine max]	58	34	705
74	3	4937	4230	gi 2293252	[AF008220] YmoO [Bacillus subtilis]	58	33	708
79	4	4594	3422	gi 1217989	ORF3 [Streptococcus pneumoniae]	58	44	1173
82	8	10585	8171	gi 882711	exonuclease V alpha-subunit [Escherichia coli]	58	38	2415
86	17	16017	15337	gi 47642	[5-dehydroquinase hydrolyase (3-dehydroquinase) [Salmonella typhi]	58	32	681
97	2	931	560	gi 153794	egg [Streptococcus gordonii]	58	32	372

TABLE 2

S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
108	2	358	2724	gi1537020	vacB gene product [Escherichia coli]	58	37	2367
111	5	4593	5240	gi11592142	ABC transporter, probable ATP-binding subunit [Methanococcus jannaschii]	58	36	648
120	3	4421	5110	gnl PID d101320	YogX [Bacillus subtilis]	58	47	690
128	16	13131	12673	gi1662919	ORF U [Enterococcus hirae]	58	42	459
132	3	6174	4939	gi11800301	macrolide-efflux determinant [Streptococcus pneumoniae]	58	35	1236
133	1	111	890	gnl PID e269488	Unknown [Bacillus subtilis]	58	36	780
160	11	8615	9865	gi1473901	ORF1 [Lactococcus lactis]	58	39	1251
161	6	6268	6849	gnl PID d101024	DJ-1 protein [Homo sapiens]	58	32	582
169	1	214	2	gnl PID d100447	translation elongation factor-3 [Chlorella virus]	58	31	213
187	1	487	2	gi1475114	regulatory protein [Pedococcus pentosaceus]	58	38	486
187	6	4384	4620	gi1167475	deacetylase-related protein [Craterostigma plantagineum]	58	55	237
190	2	1464	1640	gnl PID e246727	competence pheromone [Streptococcus gordonii]	58	38	177
192	2	2012	1344	gnl PID d100556	rat CYP360 [Rattus rattus]	58	44	669
206	1	1292	696	gnl PID e202579	product similar to WbA [Lactobacillus sake]	58	35	597
216	2	2333	555	gnl PID e325036	hypothetical protein [Bacillus subtilis]	58	33	1779
217	5	5250	4321	gi1466474	cellobiose phosphotransferase enzyme II'' [Bacillus stearothermophilus]	58	38	930
217	7	5636	5106	gnl PID d102048	B. subtilis cellobiose phosphotransferase system celB; P46317 (998) transmembrane [Bacillus subtilis]	58	44	531
232	1	2	811	gi11573777	cell division ATP-binding protein (ftsE) [Haemophilus influenzae]	58	39	810
264	1	2	715	gi1973330	Nata [Bacillus subtilis]	58	32	714
280	1	33	767	gi11786187	(AE000111) hypothetical 29.6 kD protein in thrC-talA intergenic region [Escherichia coli]	58	31	735
306	1	845	3	gnl PID e334780	YibL protein [Bacillus subtilis]	58	47	843
360	3	1536	1092	spP46351 YZGD_	HYPOPHETICAL 45.4 KD PROTEIN IN THIAMINASE I 5'REGION.	58	32	465
363	5	2160	1867	gi1160671	S antigen precursor [Plasmodium falciparum]	58	51	294
372	1	806	3	gi1393394	Tb-291 membrane associated protein [Trypanosoma brucei subgroup]	58	37	804
382	2	749	519	pir JC1151 JC11	hypothetical 20.3K protein (insertion sequence IS1131) - Agrobacterium tumefaciens (strain P022) plasmid T1	58	41	231

TABLE 2

S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
3	9	8409	7471	gi11499745	M. jannaschii predicted coding region MJ0912 [Methanococcus jannaschii]	57	38	939
10	10	7674	7507	gi11737169	homologue to SKPI [Arabidopsis thaliana]	57	30	168
11	1	2	412	gn1PID d100139	ORF [Acetobacter pasteurianus]	57	42	411
31	4	2032	1388	gi12293213	[AF008220] Ytpr [Bacillus subtilis]	57	37	645
33	11	6931	6449	gn1PID e324949	hypothetical protein [Bacillus subtilis]	57	36	483
45	5	5446	5060	gi11592204	phosphoserine phosphatase [Methanococcus jannaschii]	57	44	387
49	7	6523	7632	gi1155369	PTS enzyme-II fructose [Xanthomonas campestris]	57	35	1110
52	6	4520	6850	gi11574144	single-stranded-DNA-specific exonuclease (recJ) [Haemophilus influenzae]	57	35	2331
53	5	2079	1795	gi11843580	replicase-associated polypeptide [oat blue dwarf virus]	57	46	285
63	6	5312	4995	gi12182608	[AE000094] Y4r3 [Rhizobium sp. NGR234]	57	39	318
72	15	13883	13059	gn1PID d100892	homologous to SwissProt:YIDA_ECOLI hypothetical protein [Bacillus subtilis]	57	40	825
79	2	2561	1815	gn1PID d100965	homologue of NADPH-flavin oxidoreductase Fp of V. harveyi [Bacillus subtilis]	57	44	747
82	9	9596	9763	gi1206045	short region of similarity to glycerophosphoryl diester phosphodiesterases [Caenorhabditis elegans]	57	35	168
86	16	15371	14493	gi11787983	[AE000264] o288; 92 pct identical (1 gap) to 222 residues of fragment YDIB_ECOLI SW: P28244 (223 aa) [Escherichia coli]	57	34	879
93	3	1695	1177	gi11500003	mutator mutT protein [Methanococcus jannaschii]	57	33	519
96	6	3026	4519	gi11559882	threonine synthase [Arabidopsis thaliana]	57	43	1494
99	14	17211	18212	gi1773349	BirA protein [Bacillus subtilis]	57	44	1002
112	8	7448	7903	gi11591393	M. jannaschii predicted coding region MJ0678 [Methanococcus jannaschii]	57	30	456
113	16	18627	18328	pir1A5605 A456	mature-parasite-infected erythrocyte surface antigen HESA - Plasmodium falciparum	57	22	300
123	2	343	1110	pir1F64149 F641	hypothetical protein HI0355 - Haemophilus influenzae (strain Rd KW20)	57	38	768
123	4	2108	2884	gn1PID d102148	sulfate transport system permease protein [Chlorella vulgaris]	57	39	777
127	10	6477	5587	gi11573082	Nitrogenase C (nifC) [Haemophilus influenzae]	57	35	891
128	13	9251	9790	gi1153692	pneumolysin [Streptococcus pneumoniae]	57	38	540
131	4	2139	1363	gi142081	nagD gene product (AA 1-250) [Escherichia coli]	57	36	777

TABLE 2  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
136	1	214	1221	bbs148453	SpA-endocarditis immunodominant antigen [Streptococcus sobrinus, MUCOB 263, Peptide, 1566 aa] [Streptococcus sobrinus]	57	44	1008
140	25	28701	26851	gi1505576	beta-glucoside permease [Bacillus subtilis]	57	38	1851
141	6	6395	7438	gi1995560	unknown [Schizosaccharomyces pombe]	57	41	1044
144	3	3231	2785	gnlpid100139	ORF (Acetobacter pasteurianus)	57	42	447
155	4	5454	4564	gi1600431	glycosyl transferase [Erwinia amylovora]	57	34	891
159	9	4877	5834	gi1290509	g307 [Escherichia coli]	57	35	978
167	11	9710	9249	gnlpid100139	ORF (Acetobacter pasteurianus)	57	42	462
171	6	4023	4436	gi147402	mannose permease subunit III-Man [Escherichia coli]	57	29	414
178	4	2170	1076	gnlpid102004	[AB001488] ATP-DEPENDENT RNA HELICASE DEAD HOMOLOG. [Bacillus subtilis]	57	39	1095
190	1	145	1455	gi149420	export/processing protein [Lactococcus lactis]	57	30	1311
198	1	298	95	gi1522268	unidentified ORF22 [Bacteriophage b167]	57	36	204
203	2	3195	2110	gnlpid10283915	orf c1003 [Sulfolobus solfataricus]	57	41	1086
205	1	40	507	gi1439527	E11A-man [Lactobacillus curvatus]	57	28	468
214	7	4243	3797	gnlpid102049	H. influenzae, ribosomal protein alanine acetyltransferase; P44305 (189) [Bacillus subtilis]	57	48	447
268	3	1767	1276	gi143979	L. curvatus small cryptic plasmid gene for rep protein [Lactobacillus curvatus]	57	36	492
351	1	324	34	gnlpid10275871	PO3F6.b [Caenorhabditis elegans]	57	31	291
386	1	226	2	gi160671	S antigen precursor [Plasmodium falciparum]	57	45	225
5	5	10486	8777	gi1405857	yehu [Escherichia coli]	56	33	1710
8	5	3674	3910	gi1467199	pkac; L518_F1_2 [Mycobacterium leprae]	56	39	237
10	3	3442	1874	gnlpid101907	sodium-coupled permease [Synecocystis sp.]	56	36	1569
21	1	1880	333	gi12313949	[AE000593] osmoprotection protein (proWX) [Helicobacter pylori]	56	33	1548
22	29	21968	22456	gnlpid102001	[AB001488] PROBABLE ACETYLTRANSFERASE. [Bacillus subtilis]	56	37	489
27	1	1361	3	gi1215132	ea59 (525) [Bacteriophage lambda]	56	30	1359
28	9	4667	4278	gi1592090	DNA repair protein RAD2 [Methanococcus jannaschii]	56	29	390
33	1	3	386	gnlpid100139	ORF (Acetobacter pasteurianus)	56	41	384



TABLE 2  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
36	7	5122	5397	pir PQ0053 PQ00	hypothetical protein (proC 3' region) - <i>Pseudomonas aeruginosa</i> (strain PAO) (fragment)	56	28	276
40	4	3137	4318	gi 1800301	macrolide-efflux determinant [ <i>Streptococcus pneumoniae</i> ]	56	27	1182
40	16	12511	13191	gnl PID e217602	PluN [ <i>Lactobacillus plantarum</i> ]	56	38	681
48	17	13775	13023	gi 143729	transcription activator [ <i>Bacillus subtilis</i> ]	56	39	753
75	4	1674	2594	gnl PID d102036	membrane protein [ <i>Bacillus stearothermophilus</i> ]	56	25	921
85	3	1842	1459	gnl PID d100139	ORF [ <i>Acetobacter pasteurianus</i> ]	56	41	384
89	7	5815	4940	gi 853777	product similar to E.coli PPA2 protein [ <i>Bacillus subtilis</i> ]	56	42	876
105	2	1360	2718	gnl PID d101913	hypothetical protein [ <i>Synechocystis</i> sp.]	56	37	1359
112	3	2151	3194	gi 537201	ORF_0345 [ <i>Escherichia coli</i> ]	56	31	1044
113	4	2754	2963	gnl PID d100340	ORF [ <i>Plum pox virus</i> ]	56	28	210
122	3	1203	2054	gi 1649035	high-affinity periplasmic glutamine binding protein [ <i>Salmonella typhimurium</i> ]	56	30	852
124	8	3919	3694	gnl PID e248893	unknown [ <i>Mycobacterium tuberculosis</i> ]	56	27	246
125	4	4403	4107	gnl PID d100247	human non-muscle myosin heavy chain [ <i>Homo sapiens</i> ]	56	32	297
127	11	6608	6405	gi 2182397	[AE000073] Y4fN [ <i>Rhizobium</i> sp. NGR234]	56	35	204
134	5	4769	3849	gnl PID d101870	hypothetical protein [ <i>Synechocystis</i> sp.]	56	39	921
137	10	6814	7245	gi 1592011	sulfate permease (cysA) [ <i>Methanococcus jannaschii</i> ]	56	34	432
142	8	5019	4582	pir A47071 A470	orf1 immediately 5' of nifS - <i>Bacillus subtilis</i>	56	29	438
146	8	4676	3660	gnl PID d101911	hypothetical protein [ <i>Synechocystis</i> sp.]	56	32	1017
148	3	1906	2739	gnl PID d101099	phosphate transport system permease protein psta [ <i>Synechocystis</i> sp.]	56	36	834
150	4	4449	2743	gnl PID e304628	probably site-specific recombinase of the resolvase family of enzymes [ <i>Bacteriophage TP21</i> ]	56	27	1707
172	1	2	208	gi 1787791	[AE000249] f317; This 317 aa orf is 27 pct identical (16 gaps) to 301 residues of an approx. 320 aa protein YXAC_BACSU SW: p39140 [ <i>Escherichia coli</i> ]	56	34	207
172	7	4979	5668	gi 396293	similar to <i>Bacillus subtilis</i> hypoth. 20 kDa protein, in tar 3' region [ <i>Escherichia coli</i> ]	56	40	690
186	7	3732	3367	gi 1722200	PTS permease for mannose subunit IIPMan [ <i>Vibrio furnissii</i> ]	56	36	366
187	2	2402	819	pir SS7904 SS79	virR49 protein - <i>Streptococcus pyogenes</i> (strain CS101, serotype M49)	56	35	1584

TABLE 2

S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
204	3	2772	2239	gi 606376	ORF_0162 [Escherichia coli]	56	35	534
206	2	3342	1633	gi 559861	clm (Plasmid pAD1)	56	38	1710
219	3	1689	1096	gi 1146197	putative [Bacillus subtilis]	56	27	594
230	2	409	1485	pir C60328 C603	hypothetical protein 2 (ar 5' region) - Streptococcus mutans (strain OH2175, serotype f)	56	40	1077
233	4	2930	3268	gi 1041785	rhoptry protein [Plasmodium yoelii]	56	24	339
273	2	1543	2724	gi 143089	lep protein [Bacillus subtilis]	56	32	1182
353	1	1	516	gn PID e325000	hypothetical protein [Bacillus subtilis]	56	41	516
359	1	87	641	gi 1786952	(AE000176) o877: 100 pct identical to the first 86 residues of the 100 aa hypothetical protein fragment Y8GB_EC01 SW: P54746 [Escherichia coli]	56	46	555
363	7	4482	4198	gi 1573353	outer membrane integrity protein (tolA) [Haemophilus influenzae]	56	38	285
376	1	2	508	gn PID e325031	hypothetical protein [Bacillus subtilis]	56	33	507
18	1	836	177	gn PID d100872	a negative regulator of pho regulon [Pseudomonas aeruginosa]	55	31	660
28	4	1824	1618	gn PID e316518	STAT protein [Dictyostellium discoideum]	55	40	207
29	6	4496	5041	gi 1088261	unknown protein [Anabaena sp.]	55	31	546
38	16	9695	10702	gi 580905	B. subtilis genes rpmH, rnpA, 50kd, gida and gidB [Bacillus subtilis]	55	31	1008
49	5	5727	6182	gi 1786951	(AE000176) heat-responsive regulatory protein [Escherichia coli]	55	29	456
51	4	2381	3241	gn PID d101293	ybbA [Bacillus subtilis]	55	42	861
52	9	9640	10866	gi 153016	ORF 419 protein [Staphylococcus aureus]	55	23	1227
53	4	1813	1349	gi 896042	ospF [Borrelia burgdorferi]	55	30	465
60	5	4794	5756	gi 1499876	magnesium and cobalt transport protein [Methanococcus jannaschii]	55	38	963
71	9	14176	15408	gi 1857120	glycosyl transferase [Neisseria meningitidis]	55	41	1233
75	6	3189	4229	gn PID e209890	NAD alcohol dehydrogenase [Bacillus subtilis]	55	44	1041
108	10	10488	9820	gn PID e324997	hypothetical protein [Bacillus subtilis]	55	36	669
113	12	12273	13037	gn PID e311496	unknown [Bacillus subtilis]	55	34	765
113	13	13007	13945	gi 1573423	1-phosphofructokinase (fruK) [Haemophilus influenzae]	55	39	939
126	5	6764	5907	gi 1790131	(AE000446) hypothetical 29.7 kD protein in bpa-gyrB intergenic region [Escherichia coli]	55	37	858

**TABLE 2**  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
129	3	2719	902	gnl pid d101425	p2-peptidase (Bacillus licheniformis)	55	35	1818
138	3	2593	1610	gi 142833	ORF2 (Bacillus subtilis)	55	37	984
140	6	6916	5633	gnl pid d100964	homologue of hypothetical protein in a rapamycin synthesis gene cluster of Streptomyces hygroscopicus (Bacillus subtilis)	55	26	1284
147	3	3854	2136	gi 472330	dihydroipoamide dehydrogenase (Clostridium magnum)	55	39	1719
147	10	10204	8921	gnl pid e73078	dihydroorotase (Bacillus leichmannii)	55	38	1284
148	5	3430	4119	gi 290572	peripheral membrane protein U (Escherichia coli)	55	29	690
148	6	4171	4650	gi 695769	transposase (Xanthobacter autotrophicus)	55	37	480
149	14	12564	11650	gnl pid d101329	YqjG (Bacillus subtilis)	55	32	915
156	3	1113	550	gi 2314496	(AE000634) conserved hypothetical integral membrane protein (Helicobacter pylori)	55	34	564
159	10	6625	5897	gi 290533	similar to E. coli ORF adjacent to auc operon; similar to gntR class of regulatory proteins (Escherichia coli)	55	29	729
164	3	1784	2332	gnl pid e255118	hypothetical protein (Bacillus subtilis)	55	37	549
164	5	2772	3521	gi 40348	put. resolvase Tnp I (AA 1 - 284) (Bacillus thuringiensis)	55	35	750
164	11	7428	7216	gnl pid e249407	unknown (Mycobacterium tuberculosis)	55	38	213
167	5	3860	3345	gi 535052	involved in protein secretion (Bacillus subtilis)	55	28	516
186	5	2880	2563	gi 606080	ORF o290: Geneplot suggests frameshift linking to o267, not found (Escherichia coli)	55	35	318
189	8	4311	5396	gnl pid e183450	hypothetical EcsB protein (Bacillus subtilis)	55	32	1086
192	5	3270	3079	gi 1196504	vitellogenin convertase (Aedes aegypti)	55	38	192
195	2	2454	1384	gi 1574693	transferase, peptidoglycan synthesis (murG) (Haemophilus influenzae)	55	33	1071
198	4	3013	2471	gnl pid e313074	hypothetical protein (Bacillus subtilis)	55	29	543
214	1	373	744	gnl pid d101741	transposase (Synechocystis sp.)	55	33	372
219	2	1115	456	gi 288301	ORF2 gene product (Bacillus megaterium)	55	30	660
263	7	3742	3443	gi 18137	cgcr-4 product (Chlamydomonas reinhardtii)	55	48	300
285	1	2	829	gnl pid d100974	unknown (Bacillus subtilis)	55	40	828
286	1	650	249	gi 396844	ORF (18 kDa) (Vibrio cholerae)	55	31	402
297	2	1229	1696	gi 150848	prtc (Porphyromonas gingivalis)	55	39	468

**TABLE 2**  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
309	2	218	982	gi1574491	hypothetical [Haemophilus influenzae]	55	35	765
328	2	646	224	gi1571500	[prohibitin [Saccharomyces cerevisiae]	55	27	423
330	1	1340	474	gi1396397	soxS [Escherichia coli]	55	29	867
364	3	2538	1546	gi1393394	[fb-291 membrane associated protein [Trypanosoma brucei subgroup]	55	36	993
368	3	941	105	gi1360671	S antigen precursor [Plasmodium falciparum]	55	40	837
3	5	4604	3624	gi12293176	[AF008220] signal transduction protein kinase [Bacillus subtilis]	54	26	981
9	11	7746	7246	gi11146245	[putative [Bacillus subtilis]	54	38	501
38	24	16213	17937	gi11480429	[putative transcriptional regulator [Bacillus stearothermophilus]	54	27	1725
40	8	5076	4882	gi139989	[methionyl-tRNA synthetase [Bacillus stearothermophilus]	54	35	195
43	4	3980	2367	gnl pid ei148611	[ABC transporter [Lactobacillus helveticus]	54	25	1614
52	10	10844	12103	gi11762962	[FemA [Staphylococcus simulans]	54	29	1260
57	1	3	512	gi1558177	[endo-1,4-beta-xylanase [Cellulomonas fimi]	54	36	510
58	3	4749	4246	gnl pid d101237	hypothetical [Bacillus subtilis]	54	29	504
71	7	10684	11703	gi1510255	[orf3 [Escherichia coli]	54	31	1020
71	20	127546	127737	gi1202543	[serotonin receptor [Rattus norvegicus]	54	31	192
72	2	844	1098	gi1148613	[arnB gene product [Plasmid F]	54	37	255
72	7	7438	6695	gi11196496	[recombinase [Moraxella bovis]	54	38	744
74	10	14043	13465	gi1200342	[ORF 3 gene product [Bradyrhizobium japonicum]	54	32	579
74	12	16483	15595	gi12317798	[maturase-related protein [Pseudomonas alcaligenes]	54	30	489
86	3	2877	2155	gi146988	[orf9.6 possibly encodes the O unit polymerase [Salmonella enterica]	54	34	723
89	5	4433	3921	gi1147211	[phnO protein [Escherichia coli]	54	41	513
90	1	3	464	gi12317798	[maturase-related protein [Pseudomonas alcaligenes]	54	30	462
96	10	8058	8510	gnl pid d102015	[AB001488] SIMILAR TO SALMONELLA TYPHIMURUM SLVY GENE REQUIRED FOR SURVIVAL IN MACROPHAGE. [Bacillus subtilis]	54	32	453
97	6	4662	3604	gi11591394	[transketolase [Methanococcus jannaschii]	54	30	1059
106	11	10406	12010	gi1606286	[ORF_0637 [Escherichia coli]	54	32	1605
147	8	8663	7404	gnl pid d101615	[ORF ID:011917; similar to [SwissProt Accession Number P37340] [Escherichia coli]	54	35	1260

TABLE 2  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
171	4	2477	3223	gi 1439528	EIIC-man (Lactobacillus curvatus)	54	36	747
174	2	2068	1787	gnl pid d100518	motor protein (Homo sapiens)	54	35	282
188	1	526	1188	gnl pid e250352	unknown (Mycobacterium tuberculosis)	54	31	663
198	5	3582	2884	gnl pid e313074	hypothetical protein (Bacillus subtilis)	54	33	699
207	1	1	1641	gnl pid d101813	hypothetical protein (Synecocystis sp.)	54	24	1641
210	1	2	655	gi 2293206	(AF008220) Ycap (Bacillus subtilis)	54	29	654
225	2	966	2357	gnl pid e330194	RIH6.1 (Caenorhabditis elegans)	54	39	1392
241	1	1681	347	gnl pid d101813	hypothetical protein (Synecocystis sp.)	54	26	1335
263	2	907	1395	gnl pid d101886	transposase (Synecocystis sp.)	54	30	489
263	6	3450	2977	gi 160671	S antigen precursor (Plasmodium falciparum)	54	47	474
277	3	2517	1363	gi 1196926	unknown protein (Streptococcus mutans)	54	30	1155
307	1	828	4	gi 2293198	(AF008220) Ycap (Bacillus subtilis)	54	28	825
325	1	19	768	gi 2182507	(AE000083) Y4IH (Rhizobium sp. NGR234)	54	37	750
332	2	898	590	gi 1591815	ADP-ribosylglycohydrolase (drag) (Methanococcus jannaschii)	54	32	309
385	4	240	479	gi 530878	amino acid feature: N-glycosylation sites, aa 41 .. 43, 46 .. 48, 51 .. 53, 72 .. 74, 107 .. 109, 128 .. 130, 132 .. 134, 158 .. 160, 163 .. 165; amino acid feature: Rod protein domain, aa 169 .. 340; amino acid feature: globular protein domain	54	49	240
7	125	19702	19493	gnl pid e255111	hypothetical protein (Bacillus subtilis)	53	32	210
23	3	2497	2033	gnl pid d102015	(AB001488) SIMILAR TO SALMONELLA TYPHIMURUM SLVY GENE REQUIRED FOR SURVIVAL IN MACROPHAGE. (Bacillus subtilis)	53	25	465
29	11	9042	10121	gi 143331	alkaline phosphatase regulatory protein (Bacillus subtilis)	53	31	1080
33	3	1479	1009	pir s10655 s106	hypothetical protein X - Pyrococcus woesei (fragment)	53	33	471
36	6	4583	5134	gnl pid e316029	unknown (Mycobacterium tuberculosis)	53	30	552
38	14	8521	8898	gi 580904	homologous to E.coli rnpA (Bacillus subtilis)	53	30	378
52	7	7007	8686	gi 1337831	unknown (Bacillus subtilis)	53	29	1680
54	17	17555	19564	gi 566069	orf2 gene product (Lactobacillus leichmannii)	53	36	2010
56	1	1	681	gi 1592266	restriction modification system S subunit (Methanococcus jannaschii)	53	32	681

**TABLE 2**  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
57	10	9431	8487	gi 1788543	(AE000310) f351: Residues 1-121 are 100 pct identical to YQJL_ECOLI SW: P33944 (122 aa) and aa 152-351 are 100 pct identical to YQJL_ECOLI SW: P33943 [Escherichia coli]	53	31	945
61	1	429	4	gnl pid e236467	B0024.12 [Caenorhabditis elegans]			
71	1	5772	4	gi 393394	7B-291 membrane associated protein (Trypanosoma brucei subgroup)	53	33	426
72	3	894	2840	gi 2293178	(AF008220) YtsD [Bacillus subtilis]	53	33	5769
73	14	9793	9212	gi 1778556	putative cobalamin synthesis protein [Escherichia coli]	53	27	1947
88	7	5217	4142	gi 2098719	putative fimbrial-associated protein [Actinomyces naeslundii]	53	32	582
93	5	2395	1688	gi 563366	gluconate oxidoreductase [Gluconobacter oxydans]	53	38	876
96	9	6632	7762	gi 517204	ORF1, putative 42 kDa protein [Streptococcus pyogenes]	53	33	708
108	8	7629	8600	gi 149581	maturation protein [Lactobacillus paracasei]	53	42	1131
128	9	6412	6972	gnl pid e317237	unknown [Mycobacterium tuberculosis]	53	32	972
128	12	8439	9253	gi 311070	pantraxin fusion protein [Xenopus laevis]	53	36	561
148	1	3	950	pir A61607 A616	probable hemolysin precursor - Streptococcus agalactiae (strain 74-360)	53	31	825
163	2	2162	3022	gi 1755150	nocturnin [Xenopus laevis]	53	30	861
171	3	2304	2624	gi 1732200	PTS permease for mannose subunit IIPMan [Vibrio furnissii]	53	32	321
182	5	3785	3051	gnl pid d100572	unknown [Bacillus subtilis]	53	35	735
209	3	2948	1935	gi 1778505	ferric enterobactin transport protein [Escherichia coli]	53	28	1014
218	5	3884	2406	gi 40162	murE gene product [Bacillus subtilis]	53	34	1479
250	3	473	790	gnl pid e334776	YibH protein [Bacillus subtilis]	53	30	318
275	1	1	1611	gnl pid d101314	YgeW [Bacillus subtilis]	53	35	1611
332	1	544	2	gi 409286	bmrU [Bacillus subtilis]	53	31	543
2	2	2543	3445	gnl pid e233879	hypothetical protein [Bacillus subtilis]	52	39	901
3	22	22402	23376	gi 38969	lacF gene product [Agrobacterium radiobacter]	52	36	975
5	3	8094	2356	gnl pid e324915	IgAI protease [Streptococcus sanguis]	52	32	5739
22	26	19961	20212	gi 152901	ORF 3 [Spirochaeta aurantia]	52	35	252
22	31	23140	24666	gi 289262	ICOME ORF [Bacillus subtilis]	52	32	1527
27	6	5397	4801	gi 39573	P20 (AA 1-178) [Bacillus licheniformis]	52	35	597

TABLE 2

S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
35	10	8604	7357	gi 508241	putative O-antigen transporter [Escherichia coli]	52	27	1248
45	4	4801	3662	gnl PID d102243	[AB005554] homologs are found in E. coli and H. influenzae; see SWISS_PROT ACC# P42100 [Bacillus subtilis]	52	36	1140
48	18	114385	13726	gnl PID e205174	orf2 [Lactobacillus helveticus]	52	25	660
49	4	5321	5755	gi 2317740	[AF013987] nitrogen regulatory IIA protein [Vibrio cholerae]	52	19	435
54	4	2773	4668	gi 1500472	M. jannaschii predicted coding region MJ1577 [Methanococcus jannaschii]	52	36	1896
54	6	5250	4969	gi 2182453	[AB000079] Y410 [Rhizobium sp. NGR234]	52	40	282
66	6	8400	6955	gi 43140	TrkG protein [Escherichia coli]	52	30	1446
71	26	30659	31312	gnl PID e314993	unknown [Mycobacterium tuberculosis]	52	23	654
75	2	1673	1035	gnl PID d102271	[AB001683] Fara [Streptomyces sp.]	52	27	639
81	3	1439	2893	gnl PID e311458	[rhamulose kinase [Bacillus subtilis]	52	32	1455
81	8	4987	5781	gi 147403	[mannose permease subunit II-P-Man [Escherichia coli]	52	37	795
83	21	20687	21853	gi 143365	[phosphoribosyl aminoimidazole carboxylase II (PUR-K; tlg start codon) [Bacillus subtilis]	52	37	1167
86	6	5785	4592	gi 1276879	[EpsF [Streptococcus thermophilus]	52	26	1194
86	20	19390	17861	gi 454844	[ORF 3 [Schistosoma mansoni]	52	26	1530
96	13	10540	9659	gi 288299	[ORF1 gene product [Bacillus megaterium]	52	33	882
111	1	2	2026	gi 148309	[cytolysin 8 transport protein [Enterococcus faecalis]	52	27	2025
112	2	1457	2167	gi 471234	[orf1 [Haemophilus influenzae]	52	33	711
118	3	2931	2365	bbs 151233	[Mip=24 kDa macrophage infectivity potentiator protein [Legionella pneumophila, Philadelphia-1, Peptide, 184 aa] [Legionella pneumophila]	52	33	567
122	9	5646	5951	gi 8214	[myosin heavy chain [Drosophila melanogaster]	52	36	306
122	11	6159	6374	gi 434025	[dihydrolipoamide acetyltransferase [Pelobacter carbinolicus]	52	52	216
134	6	4880	6313	gi 153733	[M protein trans-acting positive regulator [Streptococcus pyogenes]	52	43	1434
135	3	1238	2716	gnl PID e245024	unknown [Mycobacterium tuberculosis]	52	35	1479
141	3	1681	2319	gnl PID d100573	unknown [Bacillus subtilis]	52	32	639
161	4	2562	5024	gi 1146243	[22.4% identity with Escherichia coli DNA-damage inducible protein ...; putative [Bacillus subtilis]	52	36	2463
173	2	968	183	gi 1215693	[putative orf; GT9_orf434 [Mycoplasma pneumoniae]	52	30	786

**TABLE 2**  
S. pneumoniae - Putative coding regions of novel proteins %similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
198	6	4400	3567	[gnl PID g313010]	hypothetical protein [Bacillus subtilis]	52	26	834
210	12	8844	9107	[gi 497647]	DNA gyrase subunit B [Mycoplasma genitalium]	52	38	264
214	10	5264	5431	[gi 550697]	envelope protein [Human immunodeficiency virus type 1]	52	36	168
225	1	15	884	[gi 1552773]	hypothetical [Escherichia coli]	52	34	870
230	1	39	362	[gnl PID d100582]	unknown [Bacillus subtilis]	52	28	324
287	1	871	2	[gnl PID e335028]	protease/peptidase [Mycobacterium leprae]	52	29	870
363	2	1305	4	[gi 393394]	TB-291 membrane associated protein (Trypanosoma brucei subgroup)	52	32	1302
23	2	2048	1173	[gnl PID e254943]	unknown [Mycobacterium tuberculosis]	51	30	876
29	3	742	1521	[gi 923900]	5'-methylthiodenosine phosphorylase [Sulfolobus solfataricus]	51	31	780
45	1	410	1597	[gi 1877429]	integrase [Streptococcus pyogenes phage T12]	51	32	1188
48	26	19227	18946	[gi 2314455]	(AE000633) transcriptional regulator (tenA) [Helicobacter pylori]	51	33	282
73	5	4276	4016	[gi 474177]	alpha-D-1,4-glucosidase [Staphylococcus xylosum]	51	31	261
81	11	8935	12057	[gi 311070]	pentraxin fusion protein [Xenopus laevis]	51	31	3123
83	5	1195	1986	[gnl PID d101316]	[yqf] [Bacillus subtilis]	51	33	792
98	10	7531	8538	[gi 41500]	ORF 3 (AA 1-352); 38 kD (put. ftsX) [Escherichia coli]	51	28	1008
113	6	3908	5173	[gi 466882]	[pps1; B1496_C2_189] [Mycobacterium leprae]	51	27	1266
124	1	326	57	[gi 2191168]	(AF007270) contains similarity to myosin heavy chain [Arabidopsis thaliana]	51	32	270
129	10	7286	6816	[gi 1046241]	orf14 [Bacteriophage HPI]	51	30	471
143	3	4963	3983	[gi 1354935]	probable copper-transporting atpase [Escherichia coli]	51	26	981
148	15	11359	10226	[gi 2293256]	(AF008220) putative hippurate hydrolase [Bacillus subtilis]	51	36	1134
149	8	6003	7313	[gi 1633572]	Herpesvirus saimiri ORF73 homolog [Kaposi's sarcoma-associated herpes-like virus]	51	21	1311
151	9	12092	11550	[gnl PID e281580]	hypothetical 40.7 kD protein [Bacillus subtilis]	51	34	543
159	6	2555	3208	[gi 146944]	CHP-N-acetylneuraminic acid synthetase [Escherichia coli]	51	36	654
174	1	1797	4	[gi 1773166]	probable copper-transporting atpase [Escherichia coli]	51	28	1794
265	4	2231	1773	[gnl PID e256400]	anti-P. falciparum antigenic polypeptide [Saimiri sciureus]	51	18	459
277	2	643	1311	[pir S32915 S329]	pilD protein - Neisseria gonorrhoeae	51	33	669



**TABLE 2**  
S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
350	1	890	3	gi 290509	oj07 [Escherichia coli]	51	30	888
363	4	1228	4485	gi 1707247	partial CDS [Caenorhabditis elegans]	51	23	3258
367	1	1701	4	gi 393394	Tb-791 membrane associated protein [Trypanosoma brucei subgroup]	51	32	1698
15	5	5174	4497	gnl pid e38151	F3 [Bacillus subtilis]	50	38	678
16	4	2220	2582	gnl pid e325010	hypothetical protein [Bacillus subtilis]	50	29	363
19	5	2591	4159	gi 1552733	similar to voltage-gated chloride channel protein [Escherichia coli]	50	30	1569
25	4	2701	1997	gi 887849	ORF_f219 [Escherichia coli]	50	27	705
35	1	211	417	gnl pid e236697	unknown [Saccharomyces cerevisiae]	50	33	207
39	4	3416	5152	gnl pid d100974	unknown [Bacillus subtilis]	50	27	1737
51	7	4000	5181	gi 1592027	carbamoyl-phosphate synthase, pyrimidine-specific, large subunit [Methanococcus jannaschii]	50	27	1182
51	9	7179	8303	gi 1591847	type I restriction-modification enzyme, S subunit [Methanococcus jannaschii]	50	28	1125
52	8	8740	9534	gi 144297	acetyl esterase (XyxC) [Caldocellum saccharolyticum]	50	34	795
52	16	16591	15770	gi 2108229	basic surface protein [Lactobacillus fermentum]	50	34	822
57	7	6031	6336	gi 2275264	60S ribosomal protein L7B [Schizosaccharomyces pombe]	50	40	306
71	23	29348	28383	gnl pid d101328	YqjA [Bacillus subtilis]	50	30	966
86	12	11155	10769	gnl pid e324964	hypothetical protein [Bacillus subtilis]	50	24	387
93	2	1205	330	gi 1066016	similar to Escherichia coli pyruvate, water dikinase, Swiss-Prot Accession Number P23538 [Pyrococcus furiosus]	50	24	876
96	5	1673	2959	gnl pid e322433	gamma-glutamylcysteine synthetase [Brassica juncea]	50	29	1287
98	2	218	1171	gi 151110	leucine-, isoleucine-, and valine-binding protein [Pseudomonas aeruginosa]	50	31	519
103	4	3303	2785	gi 154330	10-antigen ligase [Salmonella typhimurium]	50	26	501
115	5	6480	5980	gi 895747	putative cel operon regulator [Bacillus subtilis]	50	31	519
129	11	7559	7305	gi 1216475	skeletal muscle ryanodine receptor (Homo sapiens)	50	32	255
129	13	8192	7965	gi 152271	319-kDa protein [Rhizobium meliloti]	50	30	228
151	5	7634	6819	gi 40348	put. resolvase Tnp I (AA 1 - 284) [Bacillus thuringiensis]	50	35	816
153	1	1	597	gnl pid d102015	(AB001488) SIMILAR TO NITROREDUCTASE. [Bacillus subtilis]	50	29	597

TABLE 2

S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
155	5	5986	5432	gi 1276880	EpSG (Streptococcus thermophilus)	50	28	555
160	9	7390	6323	gi 1786983	(AE000179) o331; 92 pct identical to the 333 aa hypothetical protein YBHE-ECOLI SW: P52697; 26 pct identical (7 gaps) to 167 residues of the 373 aa protein MLE-TRICU SW: P46057; SW: P52697 (Escherichia coli)	50	30	1068
163	6	7396	8091	gnl pid d101313	Yqen (Bacillus subtilis)	50	22	696
167	6	5232	3940	gi 413926	lpa-2r gene product (Bacillus subtilis)	50	27	1293
169	2	807	130	gnl pid e304540	endolysin (Bacteriophage Bastille)	50	35	678
171	5	3168	4025	gi 606080	ORF_0290; Geneplot suggests frameshift linking to o267, not found (Escherichia coli)	50	27	858
210	11	8151	8414	gi 330038	HRV 2 polypeptide (Human rhinovirus)	50	25	264
364	1	1538	135	gi 393396	Tb-292 membrane associated protein (Trypanosoma brucei subgroup)	50	31	1604
10	7	5911	5090	gi 144859	ORF B (Clostridium perfringens)	49	24	822
26	5	10754	9768	gi 142440	ATP-dependent nuclease (Bacillus subtilis)	49	31	987
66	7	9777	8398	gi 414170	trkA gene product (Methanococcus marisii)	49	26	1380
77	6	5364	4648	gnl pid e285322	RecX protein (Mycobacterium smegmatis)	49	28	717
82	13	12689	13249	gnl pid e255091	hypothetical protein (Bacillus subtilis)	49	20	561
93	9	4866	4531	gi 40067	X gene product (Bacillus sphaericus)	49	26	336
112	5	4019	4948	gi 1574380	lhc-1 operon protein (lhcB) (Haemophilus influenzae)	49	27	930
129	7	6058	4949	gnl pid e267587	Unknown (Bacillus subtilis)	49	35	1110
135	5	3875	4438	gi 39573	P20 (AA 1-178) (Bacillus licheniformis)	49	25	564
154	2	1423	1953	gnl pid d101102	regulatory components of sensory transduction system (Synecocystis sp.)	49	29	531
156	5	2878	1637	gnl pid d101732	hypothetical protein (Synecocystis sp.)	49	25	1242
173	5	3500	2940	gi 490324	LORF X gene product (unidentified)	49	30	561
182	1	1057	2	gi 331002	first methionine codon in the ECLF1 ORF (Salmirine herpesvirus 2)	49	25	1056
192	6	5352	3667	gi 2394472	(AF024499) contains similarity to homeobox domains (Caenorhabditis elegans)	49	23	1686
253	4	1129	1350	gi 531116	SIR4 protein (Saccharomyces cerevisiae)	49	23	222
277	1	600	136	gi 396844	ORF (18 kDa) (Vibrio cholerae)	49	32	465
327	3	1435	887	gi 733524	phosphatidylinositol-4,5-diphosphate 3-kinase (Dictyostelium discoideum)	49	24	549

TABLE 2

S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
365	3	1436	132	gi 393394	Tb-291 membrane associated protein [Trypanosoma brucei subgroup]	49	31	1305
33	7	4461	3277	gi 145644	codes for a protein of unknown function [Escherichia coli]	48	26	1185
40	2	652	1776	gnl pid e290649	ornithine decarboxylase [Nicotiana tabacum]	48	29	1125
67	4	1377	2384	gi 1772652	2-keto-3-deoxygluconate kinase [Haloflex alicantei]	48	30	1008
74	2	4269	3871	gi 2182678	[AE000101] Y4w3 [Rhizobium sp. NGR234]	48	27	399
81	2	1326	541	gi 153672	lactose repressor [Streptococcus mutans]	48	33	786
81	4	2981	3646	gi 146042	fuculose-1-phosphate aldolase (fucA) [Escherichia coli]	48	30	666
97	1	602	51	gi 153794	rgg [Streptococcus gordonii]	48	29	552
110	1	1	3132	gi 1381114	prbB gene product [Lactobacillus delbrueckii]	48	23	3132
131	5	2914	2147	gnl pid e183811	Acyl-ACP thioesterase [Brassica napus]	48	27	768
133	4	3494	2628	gnl pid e261988	putative ORF [Bacillus subtilis]	48	27	867
139	6	4231	4599	gi 1049388	ZK470.1 gene product [Caenorhabditis elegans]	48	23	369
139	8	5036	5665	gi 1032725	unknown [Staphylococcus haemolyticus]	48	29	630
140	12	11936	11007	gnl pid d102049	H. influenzae, ribosomal protein alanine acetyltransferase; P44305 (189) [Bacillus subtilis]	48	27	930
146	9	5670	4654	gi 1591731	melvalonate kinase [Methanococcus jannaschii]	48	24	1017
161	3	1280	2374	gnl pid d101578	Collagenase precursor (EC 3.4.-.-) [Escherichia coli]	48	24	1095
172	11	10581	11048	gnl pid d101132	hypothetical protein [Synecocystis sp.]	48	27	468
182	4	2930	2586	gi 40067	X gene product [Bacillus sphaericus]	48	37	345
210	15	10786	11196	isp p13940 LE29	LATE EMBRYOGENESIS ABUNDANT PROTEIN D-29 (LEA D-29)	48	30	411
214	12	6231	6482	gi 40389	non-toxic components [Clostridium botulinum]	48	26	252
221	1	704	3	gi 1573364	H. influenzae predicted coding region HI0392 [Haemophilus influenzae]	48	27	702
227	2	647	3928	gi 1673693	(AE000005) Mycoplasma pneumoniae, C09_orf718 Protein [Mycoplasma pneumoniae]	48	30	3282
253	2	480	758	gnl pid e236697	unknown [Saccharomyces cerevisiae]	48	31	279
363	3	1874	1122	gi 18137	cgr-4 product [Chlamydomonas reinhardtii]	48	40	753
389	1	505	2	gi 18137	cgr-4 product [Chlamydomonas reinhardtii]	48	38	504
3	31	20879	22258	gnl pid e264778	putative maltose-binding pootein [Streptomyces coelicolor]	47	33	1380

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S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

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6	4	4089	4658	gi 39573	P20 (AA 1-178) [Bacillus licheniformis]	47	23	570
15	3	3736	1760	gnl PID d100572	unknown [Bacillus subtilis]	47	25	1977
35	115	14516	11263	gi 1773351	Cap5L [Staphylococcus aureus]	47	20	1254
51	6	3547	4002	pir A37024 A370	32k antigen precursor - Mycobacterium tuberculosis	47	38	456
55	8	10154	9273	gi 39848	U3 [Bacillus subtilis]	47	26	882
92	4	1753	3276	gnl PID e280611	PCPC [Streptococcus pneumoniae]	47	35	1524
127	9	5589	5386	gi 1786458	(AE000134) f120; This 120 aa orf is 76 pct identical (10 gaps) to 42 residues of an approx. 48 aa protein Y127_HAEIN SW: P43949 [Escherichia coli]	47	32	204
110	2	1232	1759	gnl PID e266555	unknown [Mycobacterium tuberculosis]	47	23	528
140	4	4951	3542	gnl PID d100964	homologue of hypothetical protein in a repamycin synthesis gene cluster of Streptomyces hygroscopicus [Bacillus subtilis]	47	24	1410
151	4	6814	6200	gi 1522674	M. jannaschii predicted coding region MJEC141 [Methanococcus jannaschii]	47	27	615
157	3	803	1174	gnl PID d101320	YqgZ [Bacillus subtilis]	47	25	372
178	5	3267	2155	gi 2367190	(AE000390) o334; sequence change joins ORFs ygjR & ygjS from earlier version (YGJR_ECOLI SW: P42599 and YGJS_ECOLI SW: P42600) [Escherichia coli]	47	30	1113
273	1	2	1549	gnl PID e254973	autolysin sensor kinase [Bacillus subtilis]	47	32	1548
300	2	880	644	gi 1835755	zinc finger protein Png-1 [Mus musculus]	47	22	237
54	14	14182	12638	pir S43609 S436	irofA protein - Streptococcus pyogenes	46	24	1545
88	1	2	1018	gnl PID e223891	xylose repressor [Anaerocellum thermophilum]	46	27	1017
96	7	4553	5860	gnl PID d101652	ORF_ID:034785; similar to [SwissProt Accession Number P45272] [Escherichia coli]	46	23	1308
112	1	1127	3	gi 2209215	(AF004325) putative oligosaccharide repeat unit transporter [Streptococcus pneumoniae]	46	24	1125
122	13	7308	7982	gi 1054776	hrf4 gene product [Homo sapiens]	46	34	675
127	14	9198	8125	gi 1469286	atua gene product [Actinobacillus pleuropneumoniae]	46	28	1074
132	4	7093	6197	gi 151794	irg [Streptococcus gordonii]	46	26	897
140	8	8220	7723	gi 1235795	pullulanase [Thermoanaerobacterium thermosulfurigenes]	46	21	498
140	9	9205	8315	gi 407878	leucine rich protein [Streptococcus equisimilis]	46	27	891

TABLE 2

S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
162	1	1	1125	gi 1143209	[ORF7; Method: conceptual translation supplied by author (Shigella sonnei)]	46	25	1125
199	1	1	585	gi 1947171	[AF000299] No definition line found [Caenorhabditis elegans]	46	28	585
223	3	1971	1477	sp P02562 MYSS_	[MYOSIN HEAVY CHAIN, SKELETAL MUSCLE (FRAGMENTS)]	46	27	495
232	2	760	1608	gi 1016112	[ycf38 gene product (Cyanophora paradoxa)]	46	28	849
292	1	687	220	gi 1673744	[AE000011] Mycoplasma pneumoniae, cytidine deaminase; similar to GenBank Accession Number C53312, from M. pirum [Mycoplasma pneumoniae]	46	29	468
30	8	5843	6472	gi 1788049	[AE000270] o235; This 235 aa orf is 29 pct identical (10 gaps) to 198 residues of an approx. 216 aa protein YTXB_BACSU SW: P06568 [Escherichia coli]	45	24	630
48	6	3461	3868	gi 722339	unknown [Acetobacter xylinum]	45	29	408
60	1	307	2	gi 1699079	coded for by C. elegans cDNA yk41h4.3; coded for by C. elegans cDNA yk148g10.5; coded for by C. elegans cDNA yk152g5.5; coded for by C. elegans cDNA yk59a10.5; coded for by C. elegans cDNA yk41h4.5; coded for by C. elegans cDNA cm20g10; coded	45	36	306
72	16	14371	14874	gi 1321900	[NADH dehydrogenase (ubiquinone) [Artemia franciscana]]	45	25	504
99	7	9158	7941	gi 152192	mutation causes a succinoglucon-aminus phenotype; ExoQ is a transmembrane protein; third gene of the exoYQ operon; putative [Rhizobium meliloti]	45	28	1218
127	12	7046	6606	bbs 153689	[H18=iron utilization protein [Haemophilus influenzae, type b, DL42, NTHI TN106, Peptide, 506 aa] [Haemophilus influenzae]]	45	24	441
137	5	1561	2619	gi 472921	[v-type Na-ATPase [Enterococcus hirae]]	45	33	1059
209	1	774	364	gi 304141	[restriction endonuclease beta subunit [Bacillus coagulans]]	45	28	411
314	1	604	2	gi 1480457	[latex allergen [Hevea brasiliensis]]	45	31	603
20	18	19782	20288	gi 433942	[ORF [Lactococcus lactis]]	44	26	507
87	8	7030	6452	gi 537207	[ORF f377 [Escherichia coli]]	44	26	579
166	5	4909	4037	gnl PTD a308082	[membrane transport protein [Bacillus subtilis]]	44	25	873
247	1	818	75	gnl PID d100718	[ORF1 [Bacillus sp.]]	44	20	744
32	3	1885	3876	gi 2351768	[papa [Streptococcus pneumoniae]]	43	24	1992
36	17	15467	18256	gi 1045739	[M. genitalium predicted coding region MG064 [Mycoplasma genitalium]]	43	26	2790
54	15	14656	17343	gi 520541	[penicillin-binding proteins 1A and 1B [Bacillus subtilis]]	43	27	2688
67	2	696	1352	gi 536934	[yja gene product [Escherichia coli]]	43	29	657
139	2	2416	338	gi 396400	[similar to eukaryotic Na+/H+ exchangers [Escherichia coli]]	43	24	2079

TABLE 2

S. pneumoniae - Putative coding regions of novel proteins similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)	match accession	match gene name	% sim	% ident	length (nt)
298	1	3	809	gi 413972	ipa-48r gene product [Bacillus subtilis]	43	24	807
387	1	47	427	gi 2315652	[AF016669] No definition line found [Caenorhabditis elegans]	43	30	381
185	4	4221	3127	gi 2182399	[AE000073] Y4fP [Rhizobium sp. NGR234]	41	25	1095
340	1	582	70	gnl pid e218681	CDP-diacylglycerol synthetase [Arabidopsis thaliana]	41	20	513
363	6	4205	1914	gi 1256742	R27-2 protein [Trypanosoma cruzi]	41	27	2292
368	2	2	943	gi 21783	LMW glutenin (AA 1-356) [Triticum aestivum]	41	34	942
155	3	4489	2861	gi 42023	member of ATP-dependent transport family, very similar to mdr proteins and hemolysin B, export protein [Escherichia coli]	40	18	1629
365	2	95	1438	gi 1633572	Herpesvirus saimiri ORF73 homolog [Kaposi's sarcoma-associated herpes-like virus]	40	21	1344
1	3	2979	3860	gnl pid d101908	hypothetical protein [Synchocystis sp.]	39	26	882
1	5	3814	4647	gnl pid d101961	hypothetical protein [Synchocystis sp.]	39	19	834
26	6	14035	10724	gi 142439	ATP-dependent nuclease [Bacillus subtilis]	38	20	3312
47	1	3	4916	gi 632549	MF-180 [Petromyzon marinus]	36	23	4914

TABLE 3

S. pneumoniae - Putative coding regions of novel proteins not similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)
1	4	3428	3009
1	6	4611	4964
3	2	818	994
3	3	1182	1574
3	7	5382	6497
3	25	25046	25396
3	26	25625	26317
6	2	1519	1689
6	14	12875	12618
6	15	13215	12841
6	18	15977	15390
7	12	9955	9419
7	13	10161	9910
8	6	3915	4280
9	9	6024	5704
10	8	6909	6298
10	9	7136	6888
10	11	7968	7672
12	1	1140	4
12	3	1779	1456
14	2	1913	1434
16	1	1	243
16	5	5675	3087
17	1	324	34
17	3	1451	1050
17	9	4890	4465
20	14	14544	15893

TABLE 3

S. pneumoniae - Putative coding regions of novel proteins not similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)
21	3	3359	2589
21	5	4802	4482
22	21	17099	17362
22	25	19467	19982
22	33	25540	25764
22	35	26388	26218
22	36	26382	27572
23	7	6655	6032
23	8	7132	6653
24	1	36	518
25	5	3009	2641
27	4	4819	4223
27	5	4789	4956
28	5	3017	1797
28	8	4272	3850
28	10	5028	4597
28	11	5746	5072
29	7	5596	4919
29	8	5039	5518
29	9	5595	8207
30	9	6511	6263
31	6	2664	2344
32	5	5203	5538
33	8	5327	4668
34	10	8024	7740
34	12	9360	8641
34	13	9667	9377



**TABLE 3** *S. pneumoniae* - Putative coding regions of novel proteins not similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)
34	18	13104	11902
35	11	9688	8588
35	12	11073	9670
36	2	334	1041
36	12	11120	10893
36	13	10993	11188
36	15	12172	14595
38	7	4269	4577
38	8	4480	5001
38	10	5517	5711
38	17	10732	11376
40	3	1728	3143
43	1	172	5
43	7	8884	8732
43	8	9568	9071
44	4	4831	6831
45	3	3204	3665
46	4	3875	3468
46	7	6074	7081
48	5	3196	3582
48	8	4579	4229
48	11	9323	8922
48	16	13042	12494
48	20	16342	15764
48	24	17971	18351
48	30	21979	21776
49	1	209	3

**TABLE 3**  
*S. pneumoniae* - Putative coding regions of novel proteins not similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)
50	4	3307	2672
51	5	3239	3598
52	11	12146	12883
54	7	5588	5187
54	8	6013	5459
54	9	6004	6210
54	16	17685	17506
55	9	10515	10123
55	12	11947	12141
56	3	935	1387
56	4	1496	1939
57	3	1624	2130
57	4	2100	2501
58	6	7541	7335
59	1	2	430
59	4	2416	2736
59	5	2734	3063
59	8	4743	5549
59	9	5459	5929
60	6	5741	6451
61	3	2395	1772
61	5	3316	3176
64	1	2722	2
66	2	1180	3147
66	8	9082	9495
67	3	1343	1182
69	2	1165	980

**TABLE 3** *S. pneumoniae* - Putative coding regions of novel proteins not similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)
70	5	4059	3922
70	6	4215	4057
70	9	5268	5504
71	15	20351	21901
71	16	21859	22338
71	19	26204	27556
72	9	8458	8081
73	4	3815	4216
73	6	4214	4582
73	7	4369	4773
73	10	7183	6428
73	15	9462	9668
76	1	524	195
76	2	867	535
76	11	8602	9210
80	6	7924	8109
81	1	244	2
81	10	6631	8931
83	4	1872	1150
83	17	16810	16460
84	3	4464	2929
86	2	2147	1092
86	4	3606	2875
86	19	16767	17114
87	5	5326	5000
87	7	6459	6001
87	9	7224	7006

TABLE 3

S. pneumoniae - Putative coding regions of novel proteins not similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)
87	18	17930	17670
87	19	18275	17928
88	2	1619	1840
88	4	2711	2878
88	9	6252	6016
89	3	2634	1621
89	9	7371	6868
90	2	899	2395
90	3	1143	952
91	3	2959	3141
91	4	3170	3691
91	6	4253	4573
93	1	391	2
93	6	2648	2379
93	8	4533	3712
96	1	3	182
96	2	904	632
96	3	1407	1147
96	4	1250	1420
97	9	7043	6753
99	15	18522	18692
99	17	19717	19541
100	2	4094	1980
103	1	48	299
103	6	4924	4373
104	5	6142	6735
105	7	6098	6517

**TABLE 3**  
*S. pneumoniae* - Putative coding regions of novel proteins not similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)
106	1	1	363
106	10	9832	10212
108	1	2	268
111	3	3417	3788
111	4	3809	4606
115	10	10854	10438
116	3	2873	2121
118	2	2274	1357
122	4	2698	2333
122	10	5858	6199
122	12	6301	7416
124	2	346	690
128	4	2544	3388
129	1	689	102
129	2	1011	724
129	8	6454	6056
129	9	6540	6277
129	12	7809	7621
131	3	1433	756
131	10	5972	5673
134	11	11838	11209
135	2	625	1140
136	4	2913	3830
137	2	325	134
139	12	14027	14521
139	13	14840	14532
139	14	15363	14875

TABLE 3

S. pneumoniae - Putative coding regions of novel proteins not similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)
140	20	19822	20838
142	1	1	285
146	3	760	479
146	4	1149	778
146	7	3604	2885
146	13	8223	9401
146	14	9399	10676
146	15	10052	9750
147	7	7488	7276
147	9	8913	8647
148	7	5298	4765
149	1	2	1936
149	3	2557	2880
149	9	6258	6070
150	2	1355	579
150	3	2556	1909
153	3	2061	2642
154	3	1953	1741
155	2	2181	1411
156	8	4550	4311
157	1	37	294
159	2	631	780
159	4	1384	1722
159	7	3271	4017
161	2	1332	1018
165	3	5535	4945
166	6	5406	4972

TABLE 3

S. pneumoniae - Putative coding regions of novel proteins not similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)
167	9	6075	6395
169	5	2828	3205
170	7	6485	6243
170	8	6964	6362
170	9	7303	6962
170	11	8790	7906
171	9	7150	7476
172	5	2298	1948
173	4	2913	2677
175	2	659	835
175	3	893	1789
176	2	1487	546
176	3	2200	1466
177	9	4686	4925
177	10	4923	5177
177	11	5111	5347
177	13	7396	8703
178	6	3452	3724
181	5	1853	2473
182	2	2112	1102
182	3	2617	2006
183	2	2126	2320
185	5	4683	4219
185	6	4846	4634
187	4	2940	3557
188	4	3686	4363
188	5	4183	4821

**TABLE 3**  
*S. pneumoniae* - Putative coding regions of novel proteins not similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)
188	6	5882	6493
189	5	3143	2844
189	9	5956	5564
191	1	618	4
191	11	10357	10001
192	3	2861	2268
192	4	3081	2878
192	7	6800	5331
193	3	997	839
194	4	2315	2127
195	5	6249	4543
195	6	6620	6231
196	2	1533	1849
197	1	1	861
198	9	6844	6644
200	5	5329	5769
200	6	5993	6595
204	5	3914	3276
205	2	447	1709
209	4	2038	2460
209	5	2458	2682
210	10	7370	8230
210	13	9029	10441
210	14	10439	10705
214	5	2581	2330
214	9	5065	5277
214	11	5996	5754



**TABLE 3** *S. pneumoniae* - Putative coding regions of novel proteins not similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)
217	2	541	194
218	2	914	1432
218	3	1430	1972
218	6	3639	3821
219	1	458	39
220	1	869	600
223	4	2617	1964
227	1	1	510
234	4	1539	1312
234	6	2116	1838
235	1	52	312
235	2	310	687
238	1	660	64
246	1	1	270
248	1	3	362
248	2	443	1222
254	3	2789	792
258	2	1179	1616
260	3	1770	2123
263	1	653	177
263	4	2244	1900
263	5	3569	2973
266	1	1	342
266	2	177	1022
270	2	1124	1681
272	1	857	186
275	2	1684	2295

**TABLE 3** *S. pneumoniae* - Putative coding regions of novel proteins not identical to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)
278	1	2	406
282	1	714	391
282	4	1463	1134
287	2	1119	826
288	1	540	4
289	1	684	4
291	5	1589	1858
293	2	2539	2925
294	1	21	608
296	2	494	700
296	3	670	843
302	1	261	530
309	3	559	350
310	2	249	1889
316	2	2087	1818
317	2	1048	584
318	2	313	777
319	3	477	133
327	2	912	607
331	1	1	549
333	1	2	535
333	2	465	82
333	3	127	342
341	1	1	705
345	2	895	701
346	2	750	199
349	1	1	198

TABLE 3

S. pneumoniae - Putative coding regions of novel proteins not similar to known proteins

Contig ID	ORF ID	Start (nt)	Stop (nt)
350	2	81	413
355	1	44	973
358	2	636	448
360	2	948	628
364	2	1639	1265
378	1	345	1004
379	2	683	510
381	1	109	693
385	1	150	4
385	2	269	30

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(B) COMPUTER: HP Vectra 486/33

(C) OPERATING SYSTEM: MSDOS version 6.2

(D) SOFTWARE: ASCII Text

(vi) CURRENT APPLICATION DATA:

149

(A) APPLICATION NUMBER:

(B) FILING DATE:

(C) CLASSIFICATION:

(vii) PRIOR APPLICATION DATA:

(A) APPLICATION NUMBER:

(B) FILING DATE:

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## (2) INFORMATION FOR SEQ ID NO: 1:

## (i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 5625 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: double
- (D) TOPOLOGY: linear

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO: 1:

CCAAGCAAAA CCAGCTACAG CTAAAGGAAC TTACGTAACA AACTTGACTA TCACAACCTAC	60
TCAAGGTGTT GGTATCAAAAG TTGACGTAAA CTCACCTTAA TCAGTAGTTA AAGTAATGTA	120
AAAAAGTTGA AGACGCTATG TCTCAACTTT TTTTGATGTA CGACGGGCAT GTTGATAGT	180
AGATGTGTAC TATTCTAGTT TCAATCTACT ATAGTAGCTC AGAAGTCGGT ACTTAAACGT	240
GCTATATCAA AACCAGTCCT TGAAAAACGT GGACTGGTTT CGTGTTTGA TTATTACCTT	300
GAACGACATG CGTTAAAAGT TAGTTGAACC GCCGTATGCC GAACGGACGT ACGGTGGTGT	360
GAGAGGGGCT AGAGATTATC CCCTACTCGA TTTGAAATC TAGTGGAATG AATCTGGAAT	420
AGTCCATCGA GCTTCTAAT ACTCTTCGAA AATCTCTTCA AACCACGTCA ACGTCGCCTT	480
GCCGTGCGTA TGGTTACTGA CTTTCGTCACT TCTATCCACA ACCTCAAAAC AGTGTTTGA	540
GCTGACTACG TCAGTTCCAT CTACAACCTC AAAACAGTGT TTTGAGCAAC CTGCGGCTAG	600
TTTCCTAGTT TGCTCTTGG TTTTCATTGA GTATAACACA TTGTTAGAAG TTGGTTTAAA	660
TTTCCTAATC AGTTTGTTC CAATTACCTT CGATATATTA TATCCCATAG TTAAGGTTGG	720
TCATACAGAT GATTATAGTC ATGGAGCCGT AAAACTTAGT GTTCTTTAG TTGACAAAGA	780
TGCCATGAAA AAAATATTG TAACTGTAAT AGGATATTTT GAAATAAATA TAGATGAAAA	840
TATCACCGAT ATTCTATACG TAAATGGTAC TGCTATTCTT TATCTTTATT TACGTTCAAT	900
TGTTTCAATA GTTTCGGCAA TTGATAGCAG TGAAGCAATG TTGCTACCTA TCATTAATGT	960
TTTAGAGTTA CTAGATAAAT CTCAACCTTT TGAAGAAGAA TAATTTATTA GCTCACTAAA	1020
TTGAGGGTAA GAAAAGTAA AAGCAGTAAG AAAAATGTCT TGCATTATAC AGCAACCTTT	1080
TGGGAATGAG TGGATGGATT GAATAAAATT TGATTAAGAG TGGATGATTT ATCTGTAGAT	1140
TATTATTGGA CAGTTAGTCT TGAAGTAGTC TAAGAATTAG GTTATAATCA GTAGAAGCCT	1200
TGCTAATAAT GAGGAGGTTA GTTTATGTAT AGTAGACTGA ATCTAAAATA GTACGAAACA	1260
ATTGCTAAAA CATTATAGA AATTAATTTT ACTTCCCAA TCGATTTGTT CTCATCTTAT	1320
TTCAATCCGC TATATATTAT GGTATCGAAT CTTCATCAGA ATGATAAAAT TAATCAATTG	1380
ATATCTGATT ACAAACAGAA TATGAAAGCT TTTTATATCA CTATTGAAAA ATTTATACGA	1440

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GATGATGAAA GCCTTAAGTG TTATTTTATA AAGGTTATTT CAAGTCGTTT CAAGGTAACA	1500
AGTCTAGATC AGATTGAAGC TGATAAACG ATACAAAGAA AATATTCAAG TGAGCTAAAA	1560
AAATTTATTG GATTTTATAA TGAGATTATT TGTGAGGAAA ATAGTTTCCT ACATGTACGA	1620
AAGAGGTGGT CGAGTTGGTT TAGGTAGTCG ATGCGTGAGT TGATAATTCT CAGGGTATGG	1680
ACTTCTTTTT CATGAATGAG GTAAAAGAGC AGGTATTGTT TAGAGACAAT CATCTGAGC	1740
ATATTTTCTG GATAGAGGGA GTATCCGATT TTATGATCAA AGTTAATACC GCCCTCTGGT	1800
GAGAAGATGA GTAGGTTGGT AATTTAAACT ATTAAACAGA ATTTTGTGATT AAAAGTATTA	1860
TTTCATGAGA GAAATCCTAA TTTCACAATC CATAGGCAAA CGCTTGCAAT TCGTTTTTTA	1920
TTGGACTATA ATAGGTTGGT ATAAAGCCTT CTGTAGTAAT AAAATGTAGA AGGTGTAGAA	1980
AGTAAGGATT TAGAATATTT GTAGTTAAAA ACACAATGTT GCTATTCCTT ACGATAGGGA	2040
GATAGATATG GCAATGATAG AAGTGAACA TCTTCAGAAA AATTTTGTGA AGACTGTTAA	2100
GGAACCGGGC TTGAAGGGG CTTTGCCTC CTTTATTCAT CCTGAAAAGC AGACCTTGA	2160
AGCGGTCAAG GATTTGACCT TTGAGGTTCC AAAAGGGCAG ATTTTAGGAT TTATCGGGC	2220
AAATGGTGCT GGAAGTCGA CAACCATTA AATGCTGACA GGAATTTGA AACCAACATC	2280
TGGTTTTTGT CGGATTAACG GCAAGATTCC CCAGGACAAT CGGCAAGATT ATGTCAAAGA	2340
TATTGGCGTA GTCTTTGGAC AACGCACCCA GCTATGGTGG GATTTGGCTC TGCAAGAGAC	2400
CTACACTGTC TTTAAAGAGA TTTATGATGT GCCAGACTCG CTCTTTCATA AGCGTATGGA	2460
CTTTTGAAT GAAGTCTTGG ATTTGAAGGA CTTTATCAAG GATCCCGTGC GGACTCTTTC	2520
ACTGGGACAA CGGATGCGGG CGGATATTGC GGCCTCCTTG CTCCACAATC CCAAGGTTCT	2580
TTTTTTAGAT GAGCCGACCA TTGGTTTGA CGTTTCGGTT AAGGATAATA TTCGTCGGGC	2640
AATTACTCAG ATCAATCAAG AGGAAGAAAC TACCATTCTT TTGACCACTC ACGATTGAG	2700
TGATATTGAG CAACTTTGTG ATCGGATTTT CATGATTGAC AAGGGCAAG AGATTTTGA	2760
TGGAACGGTG AGCCAACCTA AGGAGACCTT TGGTAAGATG AAGACTCTCT CTTTGAACCT	2820
GCTACCAGGT CAAAGTCATC TCGTCTCTCA CTATGACGGT CTGTCTGATA TGACCATGTA	2880
TAGACAAGGA AACAGCCTCA ACATTGAATT TGATAGTTCT CGCTACCACT CAGCTGACAT	2940
TATCAAGCAA ACCCTGCTG ATTTTGAAAT CCGCGATTG AAGATGGTGG ATACGGATAT	3000
TGAGGATATT ATCCGTCGCT TCTACCGAAA GGAGCTCTAG GATGATCAAA TTGTGGAGAC	3060
GTTATAAACC CTTTATCAAT GCAGGGGTTT AGGAGTTGAT TACTTACCGA GTCAACTTTA	3120
TTCTCTATCG GATTGGCGAT GTCATGGGG CTTTGTGGC CTTTATCTC TGAAGGCTG	3180

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TCTTTGATTC TTGCAAGAG TCTTTGATTC AGGGCTTCAG TATGGCGGAT ATCACCCCTCT	3240
ACATCATCAT GAGTTTGTG ACCAATCTTC TGACTAGATC CGATTCTGCC TTTATGATTG	3300
GGGAGGAGGT CAAGGATGGC TCCATTATCA TGCCTTTGTT GCGACCAGTG CATTTTGCGG	3360
CCTCCTATCT TTTACCGAG CTTGGTTCCA AGTGGTTGAT TTTTATCAGC GTTGGCCCTTC	3420
CATTTTAAAG TGTCATTGTC TTGATGAAAA TCATATCGGG TCAAGGTATT GTAGAGGTGC	3480
TAGGATTAAC TGTCATTAT CTTTTAGCT TAACGCTCGC CTATCTGATT AACTTTTCT	3540
TTAATATTG CTTTGGATT TCAGCCTTG TGTAAATAA TCTTTGGGGT TCCAACCTAC	3600
TTAAGACTTC CATAGTGGCT TTTATGTCGG GGAGTTGAT TCCCTTGCCA TTTTTCCTCA	3660
AGGTGTTTC AGATATTCTC TCCTTTTGC CTTTTCATC CTTGATTAT ACTCCAGTTA	3720
TGATCATTGT TGGAAAATAC GATGCCAGTC AGATTCTCA GGCACCTCTT TTGCAGTTCT	3780
TCTGGCTCTT AGTGATGGTG GGATTGTCTC AGTTAATTG GAAACGGGTC CAGTCCTTTA	3840
TCACCATTCA AGGAGGTTAG TATGAAAAA TATCAACGAA TGCACTGAT TTTTATCAGA	3900
CAATACATCA AACAAATCAT GGAATATAAG GTAGATTTG TGGTTGGTGT CTTGGGAGTC	3960
TTTCTGACTC AAGGCTTGAA TCTCTGTTT CTCAATGTC TCTTCAACA TATTCCATTC	4020
CTAGAAGGCT GGACCTTCA AGAGATAGCT TTCATTATG GATTTTCCTT GATTCCCAAG	4080
GGAATGGACC ATCTCTTTT TGACAATCTC TGGGCACTAG GGCAACGCCT AGTCCGAAAA	4140
GGGGAGTTG ACAAGTATCT GACTCGTCCC ATCAATCCTC TCTTTCACAT CCTAGTTGAA	4200
ACCTTTCAGA TTGATGCCTT GGGTGAATC TTAGTCGGTG GTATTTTATT GGGAAACAACA	4260
GTGACCAGCA TTGTTGGAC TCTTCCAAA TTCTGCTTT TCCTAGTTTG TATTCCTTTT	4320
GCGACCTGA TTTATACTTC TCTTAAATC GCAACAGCCA GTATCGCCTT TTGGACTAAG	4380
CAGTCAGGCG CCATGATTTA CATCTTCTAT ATGTTCAATG ACTTTGCTAA GTATCCGATT	4440
TCTATTACA ATTCTCTCT TCCTGGTTG ATTAGCTTTA TCCTGCCTTT CGCCTTTACA	4500
GCCTACTATC CAGCTAGCTA TTTCTTACAG GAAAAGGATG TGTCTTTAA CGTAGGAGGT	4560
TTGATGTTGA TTTCTCTGTT TTTCTTGTG ATTTCCCTTA AACTTTGGGA TAAGGGCTTA	4620
GATTCCTACG AAAGTGGGG TTCGTAAAAG CTAAAGTAAG ACTAAAATCA AGAAAGAAAC	4680
TTATGATGTT TGTAATTGAA GAAGTCAAGG ATGAAAATCA AAAAAAGGCA GTTGTGCTG	4740
AGGTTTGAAG GGATTGGCCA GAATGGTTTG GAATCCAGA AAGCACACAA GCCTATATAG	4800
AAGGAACCAC GACACTGCAA GTTGGACCG CCTATCAGGA GAGTGATTTG ACTAGATTTG	4860
TAAGCTTATC CTATTCGAGT GAAGATTGTG CAGAGATTGA TTGTCTCGGC GTAAAAAAGC	4920
TTATCAAGGT AGAAAAATTG GGAGCCAATT GCTTGCTACT TTAGAGAGTG AAGCTCGTAA	4980



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AAAAGTTGGT TATCTGCAGG TCAAAACAGT GGCAGAAGGT TCTAATAAAG ATTATGATCG	5040
AACAAATGAC TTTTATCGAG GTCTTGGCTT TAAAAAGTTA GAGATTTTTC CTCAACTATG	5100
GAATCCGCAA AATCCTTGTC AGATTTTGAT TAAAAAGCTT GAATAATATT ACTTGACATC	5160
TATTCTCAGA GTGCTATACT GTAAGTGTA TCGCCGATTT AGCTTAGTTG GTAGAGCAAG	5220
GCACTCGTAA AGCCTAGGTT ATAGGTAGAT AAACGACTGA GGATTTGAAA AAATAGATAG	5280
GTAGAAGATA ACCGTTAAGC CTTACTCTTA GCGGTTATTT ATATTGTTTA ATAGCGCTAA	5340
TATTTTATCA ATTATGCCTG TTTTCGTGTT TCTGGTAGTT GTTCAAGTTT ATTGCTACTA	5400
TTTTTGATGG TATGAATGTG CTTATAATGT ATCCCGGTTA ACGAAAGTTT TGGACTTATA	5460
CTCTTCGAAA ATCTCTTCAA ACCACGTCAA CGTCGCCTTG CCGTGCCTAT GGTATGACT	5520
TCGTCAGTTC TATCCACAAC CTCAAAACAG TGTTTTGAGT GACTACGTCA GTTCCATCTA	5580
CAACCTCAAA ACACTGTTTT GCCCAATCTG CGGCTAGTTT CCTAG	5625

## (2) INFORMATION FOR SEQ ID NO: 2:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 7571 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO: 2:

CTCTCCAGCT TTCCTTGGCA GTTGGCCATG TTGTGTCTTT AAGAAGTCTA AAAATATCTC	60
CAATAAAACG CATCGCTCTC TCCTATCTCG TTTCTCTGTG TGTAGTGAC TTGCCACAAT	120
GCTTACAAAA TTTATTACT TCTAGTCGTG TAGGCTTGAG GTTCCGCTG ATCTTGATTG	180
AATAGTTTCT CGAACCACAA ACCGCACAAG CTAGGCTTGC TTTTTTAGT GCCATAACGC	240
CTCCATCTTA TCCATTATAA CAAGAAAGCT AGGCTTTGAC AAGCATCTTA GCGAAATAGA	300
TTGACTATCG AATCCCATAT TGTTTGAGCC TTTTCCTTAA TCTTCGCATC TGAGATAGCC	360
CGGCTAGCCT CATCTACTAG ACTTTGCGCA CGCCCTCGAA TATCAGACAA ATTATCATCT	420
GTCTGGCTAT TATCATTTGGT TTGTACTTGT CTTTTTGAT TGGCTGGTGC AATTCCATTT	480
TGCTTATAAG CATTTTCAAC CGTAAAGGTA CTTCTGGCG TATAAGGTAA AATGGTATTG	540
GCAATGTTTC TAAAGACATG AGCTGCACCG TTTGAAGTAG AGCCAGCTAG ATAGTGGTTT	600
TCATCAGTGG TCGGAAAGCC AAGCCAGTGG CTAATCACTA CATCCGAGT ATAACCAATT	660
ACCCACTGGT CACTTGTGTA CTCGGATTG AAAACTGCTT CAGTTGTTC AGTTTTCCCT	720

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GCCATGACAT AGTCTGCAGG CGATGAACTA ATACCGGTAC CGTTGGTGAA AGTCCCCAAC	780
ATCATACTGG TCATCTGTGC AGCTACAGAC TTATCAATCA CCCGTTTTTG TGAATTTTAA	840
TGACTCGCAA TAACCTGTCC ACTAGCATTT TCAATTCTAC TAATAAAATG AGCTTCAGGC	900
ATTAAACCTT CATTTGCAAA GGCGGCGTAT GCTTGAGCCA TTTGAAGAGG GTTGGTTTCA	960
ACACCGCTTC CCAAGGCGAC ACCAAGAACA CGGTCGACCT TTTCCATGTT GAGTCCGAAT	1020
TTTTCGCCTG CCTCAAAAGC CTTGTGACAA CCCAAATCAT TAACAGTGGC AACAGCAGGT	1080
AGATTAAGCG ATTCTGCCAA GGCTTGATAC ATAGGAACTT CTCGACTCGT TTTGATCCCT	1140
GCATAGTTAT CAACCTTATA GCTGTCATAC TGCATGGTAT GGTATATCAA CTGCTTATTC	1200
AAAGCCCAGC TTGCTTCAAC TGCTGGCGTA TAAACAATA AAGGCTTAAT TGTAAGACCA	1260
GGACTACGCT TTGATTGGGT TGCATAGTTG AAATTCGGA ATCCAGTTTT ATCATTTGCA	1320
GCAACTTGAC CGACAATCC ACGAACTCCC CTTGTTTTCG GTTCGAGGGC TACACTTCCT	1380
GATTGAGCAA ACGTTCCATC CTCTGCCCTC GGAAATAGCG ATGTGTTTTT ATAAACAATC	1440
TGCATATTTG CTTGGTAGTT TTGGTCCAGC TCTGTGTAAT TGCGGTAGCC ATTATTGACA	1500
ATCTCTTCCT CTGTTAGATT ATACTTGAA ACAGCTTCAT TAACCACCGC ATCAAAATAA	1560
GAGGGGTAAC GGTAACTGA GATTTTTCCT TCATACTTAT CGTGCAATTG CGAAGTCATA	1620
TCAACTTCAG CAGCTTTGGT TTCTTGTTTT TTATCAATAT ATCCTGCTGC AACCATATTC	1680
TGCAAGACAG TATCGCGCCG ATTAGTAGAA TCTTCTACGG AATTCAAGGG ATTATACAGT	1740
TCCGGCCCCC TGAGCATCCC TGCCAGAGTC GCAGCTTGAT CCAGACTCAC TTCTGATGCA	1800
GAAACTCCAA AGTATTTCTT ACTCGCATCT TCTACACCCC ACACACCATT TCCAAAATAA	1860
GCGTTGTAA GGTACATGGT TAGAATTGTC TCCTTACTAT ATTTTTTGCT TAATTCTAAG	1920
GCAAGGAAAA ATTCTTTTCG TTTTCTCTCA ACAGTTTGAT CCTGCGATAA ATAGGCGTTT	1980
TTAGCCAGCT GTTGGGTAAT GGTAGAGCCA CCACCTGAAC GTCCAGCAGT GACAATAGCC	2040
AAGAAAAAAC GGCCATAGTT AATCCCGTCA TTTTATAGA AAGAACGGTC TTCTGTCGCA	2100
ATAACAGCAT TCTGCAAGTT TTTACTGATG TCAGTCAGCT CAACATAGGT TCCCTTTTGA	2160
CCAGACAAGG CACCAGCCTC TTTTCTTCA CGGTCAAAAA TAAGAGTCCG AGTTTTCAAG	2220
GCATTTTGCA AATCATTGAC ATTGGTCGAC TTGGCTACAG CAAACAAATA GATTCCAAT	2280
AGCAAGCCTG CACTCAAACC TAGTATAAGG ATAATCTTTG TTAGATGATA ACGACGCCAG	2340
AATTTTCGAA TCGGACCTAC TTGGGCTAAT TTTTTCGAT CACTACGAGA GCGACGTAAG	2400
ATAGTAGAAT CAGAGTCCTC TAGTTCACCT GTTCTTTTTT TAAAAAGAGA AAGAAATTC	2460
TCAAATAATT TATCTAATTT CATGCGTTTA TTTTATCATC TTCATCATAG GAAGACAAGA	2520

ATTTAGCTAT TTCCTATCCA AATAGGGCTT TTTTGTAC AATATCTGTA TGCAATTCAC	2580
ATTTACATTA CCCGCCTCTC TACCTCAAAT GACAGTAAAG CAATTACTTG AGGAACAACT	2640
CCTCATCCCT AGAAAAATCC GTCATTTTTT GAGAATCAAG AAACATATTT TGATAAATCA	2700
AGAAGAAGTC CACTGGAAGG AAATCGTAAA TCCTGGAGAT GTTTGCCAGT TGACTTTTGA	2760
CGAGGAAGAT TATTCCCAAA AGACGATCCC TTGGGGCAAC CCAGACTTAG TGCAGGAAGT	2820
TTATCAAGAT CAACACTTGA TTATTGTAAA CAAACCAGAG GGGATGAAAA CGCATGGTAA	2880
TCAACCAAAC GAAATTGCCC TTCTTAACCA TGTCAGTACC TATGTTGGCC AAACCTGCTA	2940
TGTCGTTTCAT CGTCTGGACA TGGAAACCAG TGGCTTAGTT CTCTTTGCCA AAAATCCTTT	3000
TATCCTGCCC ATTCTCAATC GCTTATTGGA GAAAAAGAG ATTTCTAGAG AATATTGGGC	3060
TCTAGTTGAT GGAATATCA ACAGAAAAGA ACTTGTTC AGAGACAAA TTGGACGTGA	3120
TCGCCATGAT CGTAGAAAA GAATAGTTGA TGCAAAAAAT GGGCAATATG CTGAAACGCA	3180
TGTAAGCAGA TTAAAGCAAT TCTCAAACAA GACTTCCTTG GCTCATTGCA AGCTAAAGAC	3240
AGGGCGAACC CATCAGATTC GTGTGCACCT TTCGCATCAT AATCTTCCTA TCCTGGGAGA	3300
CCCTCTCTAT AATAGTAAAT CAAAGACAAG CCGGCTTATG CTTTCATGCCT TCCGACTTTC	3360
CTTTACCCAC CCCTTACTT TAGAGAAGCT AACTTTCCT ACCCTTTCAA ATACATTGA	3420
AAAAGAATTA AAAAAGAATG GATGATCGTG TCATCCATT TTCCATATAA AAAAGCAAGA	3480
CCACAAAGCC TTGCTTTCTA TCAACTCAAG AATTATTTAG CAATTTTTCG GAAGTATTCA	3540
AGAGTACGAA CAAGTTGTGC AGTGTATGAC ATTTGTTGT CGTACCATGA TACAACTTA	3600
ACCAATTGTT TACCGTCAAC GTCAAGAACT TTAGTTTGAG TTGCGTCAAA CAATGAACCG	3660
TAAGACATAC CTACGATATC TGAAGATACG ATTGATCTT CTGTGTAACC GTATGATTCG	3720
TTTGAAGCTG CTTTCATAGC TCGTTCACT TCATCAACAG TAACGTTCTT TTCAAGAACT	3780
GCTACCAATT CAGTAACTGA TCCAGTTGGA GTTGGAACGC GTTGTGCAGA TCCGTCAAGT	3840
TTACCATTCA ATTCTGGGAT TACAAGACCG ATAGCTTTTG CAGCACCAGT TGAGTTAGGA	3900
ACGATGTTTG CAGCACCAGC GCGAGCACGG CGAAGGTCAC CACCACGGTG TGGTCCGTCA	3960
AGGATCATTT GGTCAACAGT GTAAGCGTGG ATAGTAGTCA TCAATCCTTC AACACACCA	4020
AAGTTGTCTT GAAGAGCTTT AGCCATTGGA GCCAAGCAGT TTGTAGTACA TGAAGCACCT	4080
GAGATAACTG TTTCAGTACC GTCAAGAACG TCGTGGTTAG TGTGAATAC AACTGTTTA	4140
ACGTCGTTTC CACCAGGAGC AGTGATAACA ACTTTTTTAG CTCCACCTTT AAGGTGTTT	4200
TCAGCTGCTT CTTTCTTAGC AAAGAAACCA GTAGCTTCAA GAACGATTTT TACACCGTCA	4260

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GTAGCCCACT	CGATTGTTC	TGGATCACGT	TCAGCAGAAA	CTTTGATGAA	TTTACCGTTA	4320
ACTTCAAATC	CACCTTCTTT	AACTTCAACA	GTACCGTCGA	AACGACCTTG	AGTTGTGTCG	4380
TATTTCAACA	AGTGTGCAAG	CATAACTGGA	TCTGTAAGGT	CGTTGATGCG	TGTAACCTCA	4440
ACACCTTCTA	CGTTTGGAT	ACGACGGAAA	GCAAGACGAC	CGATACGTCC	GAAACCGTTA	4500
ATACCAACTT	TAACACCATT	TAGTGATTTC	CTCCTTATGA	AAATCATGAA	ATTTTATTG	4560
TGAAAAGAGT	AACTTGAATC	ACTACAAATC	ACCTTTCAAC	AAACCTATTA	TACAACTATT	4620
TGAGTTGAAT	TGCAAGTATG	GCCATTGTTT	TTCTATGTTA	GTTTCTTTT	AAGACTGTAA	4680
ACCAAGGAAT	CCCTTACTAT	TCATAGCATA	ACGATTCTAT	AGGATCCATT	TTACTAATCT	4740
TACGCGCCCG	GAAGTAGGCT	GAGACATAAC	CAAGTAATAG	AGCGAAAAC	AGAGTTCCTA	4800
AAACAGATAA	AAGATTTAAT	TAAAAACCT	TAGTGATGGA	TGGGTAAAG	TGACTTACAA	4860
TCGCATTGCG	CAAACCTCCC	ACCCCTTGTG	CAACCAAAAA	TGCCAGCAGC	AAGGCGATGC	4920
CTACAATCCA	GATAGCCTCG	TAAATAAAAA	TTCCCTTGAC	ATCACGATTC	TGATAACCAA	4980
CTGCTTTCAT	GACACCTATT	TCCTTGGAAC	GTTGCATGAT	ATTGATGTAA	ATAATGATAC	5040
CAATCATAAC	CGCTGCTACC	ACAATAGCTT	GTGATGAAAG	CACAATCAAT	AATCCCTGAA	5100
TAACACGAAT	AAAGGTAATC	ACAATATCAA	GAACCTCTCTG	TTGAGAAAGC	ACAGTATACT	5160
TCTTATTTT	CTGTAATCT	TCTGTACTA	CTTTGTCTG	TGATGGATCT	TTGAGTTCCA	5220
AGATAAAATA	AGATACAGCT	TTCTGAAATC	CAGCCTCTTT	CAAAATCGTT	TCCATTGAT	5280
GAGACAGCAT	GAAACTGTTG	CTGTCCTCCA	TGTCATCTTC	ATCATTGATT	ACAGGTACAA	5340
TCTTCGTTTG	AAATGAGCA	ATCTTACTAG	TTTCGGCAGC	ACTTCTTACA	ATGCTGGCTG	5400
AGACTGATTT	GCCAATAAGA	TCATTAGCTG	TCAAATTTT	TCCTGTCTGT	TCATTCCAAT	5460
TTTTTAGTAA	ACTGCTTGGA	ATCGTTAATC	CCTGTTCAAT	TGTATCAGTA	TAGAGGGATC	5520
CAGCCAACAC	TTTGTCCGTC	TCATTATTAC	TAACAGAGAT	ACTTGATCA	TCATAAAGAC	5580
TCACTACTTG	AGCATAAGAA	GGCATCGTTT	GACTCAGATC	CATTCTTGC	CCATCTATAG	5640
TAATATTGA	CATGTTCAATC	CCAAAAGGAC	TCTCCAAATA	TTTAATAGCT	TCTTTCCCAA	5700
CTGTATCCGT	GATATATAGT	CAATTGAAAC	AAGAGCAGGA	TAAAAAAGCC	TCGTAAAAGG	5760
TATTGCAACT	TGGTAATACC	TTTTTGAGGT	GCTTTTGTGAT	ATGAGCCCAT	GTTTCTCAA	5820
TAGGATTGTA	CTCAGGCGAG	TAGGGAGGAA	GAGGTAAAAG	TTTATGCCCA	AACTCTTCGC	5880
ATAAAAGTTC	TAGCTTCCCC	ATTCTATGGA	ATCTTACATT	ATCCATAATA	ATAACCGATG	5940
GTGTGTTTAA	TGTTGGTAAG	AGAAAATCT	GAAACCAAGC	TTCAAAAAAG	TCGCTCGTCA	6000
TCGTCTCTTC	GTAAGTCATT	GGAGCGATTA	ATTCACCATT	TGTTAGACCT	GCAACCAAAG	6060

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AAATCCTCTG ATATCTTCTT CCAGATACTT TGCCTCTTAT TAATTGACCT TTTAATGAGC	6120
GACCATATTC TCGATAAAAA TAAGTATCGA ATCCTGTTTC GTCAATCTAA ACAGGTGCTA	6180
GGTGCTTTAA ACTATTAAAA TTCTTAAGAA ATAAGGCTAC TTTTCTGGG TCTTGTTTCA	6240
AGTAGGTGTG GTTCTTTTTT CGAGGTAGC CCATAGCTTT GAGCGTATAG TGGATGGTAG	6300
TTGGATGACA GCCAAATTCA GAAGCTATTT CAGTCAAATA AGCGTCTGGA TTGTCAGTAA	6360
GATAGTTTTT AAGTCTATCT CTATCAACCT TTCTTGTTT TATTCCTTTT ACTTGGTGGT	6420
TTAGCTCTCC TGTCTTCTCT TTTAGCTTTA ACCAGCCATA AATGGTATTA CGTGAGATTT	6480
GGAAACGTG TGATGCTTCT GTTATACTAC CTGTCGCTC ACAATAAGAG AGAAGTTTTT	6540
TACGAAATC TATTGAATAT GCCATAAAAA GATTATACCA CATGTGTAC TATTTTGGT	6600
TCATTTTACT ATATTTGAAG AGGCGTTTAA ACTATCTGAC ATAAAACTCG TTCTAGAGGA	6660
AAGACATCCT TAAAAAGTT AGTTTATTTT ACAACTTAGA CATCAAGGTA GGTAAACCC	6720
TTTCATGAAA AATCAAGACT CTTAGCACTA TGGGTAAAC TACCACTGGA GACGTAATCA	6780
ATCGCTAAAC CACGAAACG GCTAATAGTG GTCATATCAA TATTTCCAGA ACATTCAATC	6840
CGAGAACGTC CTGCAATTAG GGTAAATGGCC TGTTCATCT GTTCCAATGA CATATTATCC	6900
AACATGATAA TATCAGCACC CGCCGCCGCA GCTTCTTCGG CAGCAGCAAG GCTTCCACT	6960
TCCACCTCGA CCATTTTCAC AAAAGGGGCA TAGGCACGCG CTTGAGCAAT TGCCTTTTGA	7020
ACACTACCTA CTGCCGCAAT GTGATTGTCT TTTAGCAGGA TAGCATCTGA TAAATTAAAG	7080
CGATGATTAT AGCCACCGCC AACTCTCAG GCATATTTCT CAAAAAGACG TAAATTAGGA	7140
GTAGTTTTTC GAGTATCAAA TACCTTAATG CAATCATCGC CTAAGGCTTC TACATAAGCA	7200
GCTGTCATCG AAGCAATCCC TGATAAATGT TGTAATAAAT TCAAGGCAAC GCGTTCACAT	7260
GTTAAGAGAC TTCTCACC GA CCTATGATT TCTAAAACCA AATCGCCACT AGTCAAACGA	7320
TCCCCATCCT TAAATTGATG AGGATTCTGG AAGGTCACCT CGGCATCAAA TAGGGTAAAA	7380
ACCCTTTGAA AAACGGTTAG CCCCCTAAA ACACCAGCTT CCTTGGCAAA AAGCGACACC	7440
TTGGCTTGGC CATGATGATC AAAAATGGCA TTGGTACTGT AATCTTCGGA ATGAACATCT	7500
TCTCGCAAGG CTGCTTTCAA TGTATCATCT ATTTGAAAAG GGGTTAAATC AGTTGAAATG	7560
ATTGACATCA C	7571

(2) INFORMATION FOR SEQ ID NO: 3:

- (i) SEQUENCE CHARACTERISTICS:
  - (A) LENGTH: 26385 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double

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(D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 3:

TTTGCTAGTG GCTTAAATTC TTCAGGAAAA TCAGGCGTAT CTAAAAGTCG TGTCGTTTTT	60
GTTTCATCTA TATAAGACT TCCTGCTCCC CCTACAATA GAAAACGTGT CTGTGTTCCA	120
GCAAGAAGCT GATTAAATAG TTCGATTGAT TTGCTGTGGA GCGGTAGCGT ATCTGGTGTA	180
TAAGACCAA ACGCTGAAAT AACAGCATCA AATCCAGTAA GATCATCTTT TGTCAACTCA	240
AATAATCTT TTTTAATAAT AGACTCAGCT TGACTTTTGT TTTCAGAAG AACAAATAGCC	300
GTTACTTCAT GTCCCTCGTT GACTGCTTCT TCAACAATTG CTTTCCCCGC TTGTCCATT	360
GCTGCAATAA CTGCTAGTTT CATTTTTTAT ACCTCTCTTG TTGTAATTAT TTTAGTTACA	420
GAAATGTGA CACTCTTAAT AATCAATGTC AATAGTCTTG CTTAATTATT ATCAAAATAT	480
TTCTACCAAG AAAACTAACC ATGATTCTAG TGAAAAAAA TCTTCTTTGT CAACAAATTT	540
ACTTCTTGT TTAAACATG CTATAATAAT CATAGCAAGA GATCTAAGTT GTCTGTTTTT	600
TTAAACGAG GTGATTATCA TCGGTAGATT CTATTCCCAT CTCCCCTACT ATCTGGTCAT	660
ATTATCTTT TATTGGCCAC TTTATGAGTT GTTCTTACTA GTTGTTTCTG ACCCCCTTAC	720
ACTCAAGGGA CTCTATATA ACAATCTTCT CTCTTTTACA CCTCTGGTAA TCTTGATTGT	780
ATCGTTACTC TATAGCTACC GTTTCGTTT CTCACTTTGA TGGTTAGTTG GTAACGGACT	840
GCTCTTTTAC TTTACTATCA TAACCTTTGG TGAGTTTATA CTAATTTACT TGCTAATCTA	900
TGAAACAGTT GCTCTGGTCG GCATGGATTG TGGTATTAGC ATCAAGCATA TTCTACAAAA	960
AATGAAAAAC AAAAACTTT CACAAAATCC TTGAAAAATC TCACAATCAT GCTATAATAA	1020
TCCATAGAGA CAAGTCACCT AGTCCCTTTC TACTAGAGAG TCGGTGGTTG CTGGAAACGC	1080
ATAGGAAGTC TAAACTGATA CTACTCTTGA GTTTTTTATG AAAACATAAA ACGGTGGCCA	1140
CGTTAGAGCC GATCAGAGGT GTCCCTCTCT TTTGAGGTAC ATAAATGAAG GTGGAACCA	1200
GTTGCGACGT CCTTTCGAGG ATGTCGCATT TTTTATTAG GATACTAATT ATGGAGTTGC	1260
AAGAATTAGT GGAGCGCAGT TGGGCAATCC GACAAGCTTA TCACGAACCTG GAAGTTAAGC	1320
ATCATGATTC CAAGTGGACG GTAGAAGAAG ACCTCTTGGC TTTATCTAAT GATATTGGAA	1380
ATTTCCAACG ACTGGTGATG ACAAAGCAAG GACGCTACTA TGATGAAACA CCCTACACAC	1440
TGGAACAAAA ACTTTCAGAA AATATCTGGT GGCTATTAGA ACTTCTCAA CGTTTGGATA	1500
TAGACATTCT GACGGAAATG GAAACTTCC TCTCTGATAA AGAAAAGCAA TTGAACGTTA	1560
GGACTTGGAA GTAGTCTGCT GATAAAAAAT CAATGCTTAG AACTATGAA ATAATAAAAA	1620

AGGAGAACAT CATGATTAAC ATTACTTTCC CAGATGGCGC TGTTCGTGAA TTCGAATCTG	1680
GCGTAACAAC TTTTGAAATT GCCCAATCTA TCAGCAATTC CCTAGCTAAA AAAGCCTTGG	1740
CTGGTAAATT CAACGGCAAA CTCATCGACA CTACTCGCGC TATCACTGAA GATGGAAGCA	1800
TCGAAATTGT GACACCTGAT CACGAAGATG CCCTTCCAAT CTTGCGTCAC TCAGCAGCTC	1860
ACTTGTTCGC CCAAGCAGCT CGTCGTCTTT TCCCAGACAT TCACTTGGGA GTTGGTCCAG	1920
CCATCGAAGA TGTTTCTAC TACGATACTG ACAACACAGC TGGTCAAATC TCTAACGAAG	1980
ACCTTCCTCG TATCGAAGAA GAAATGCAAA AAATCGTCAA AGAAAACCTC CCATCTATT	2040
GTGAAGAAGT GACTAAGAC GAGGCACGTG AAATCTTCAA AAATGACCCT TACAAGTTGG	2100
AATTGATTGA AGAACACTCA GAAGACGAAG GCGGTTTGAC TATCTATCGT CAGGGTGAAT	2160
ATGTAGACCT CTGCCGTGGA CCTCACGTTT CATCAACAGG TCGTATCCAA ATCTTCCACC	2220
TTCTCCATGT AGCTGGTGCG TACTGGCGTG GAAACAGCGA CAACGCTATG ATGCAACGTA	2280
TCTACGGTAC AGCTTGGTTT GACAAGAAAG ACTTGAAAAA CTACCTTCAA ATGCGTGAAG	2340
AAGCTAAGGA ACGTGACCAC CGTAACTTG GTAAAGAGCT TGACCTCTTT ATGATTTCAC	2400
AAGAAGTGGG ACAAGGTTT CCATTCTGGT TGCCAAATGG TGCGACTATC CGTCGTGAAT	2460
TGGAACGCTA CATCGTAAAC AAAGAGTTGG TTTCTGGCTA CCAACACGTC TACACTCCAC	2520
CACTTGCTTC TGTGAGCTT TACAAGACTT CTGGTCACTG GGATCATTAC CAAGAAGACA	2580
TGTTCCCAAC CATGGACATG GGTGACGGG AAGAATTTGT CTTTCGTCCA ATGAACTGTC	2640
CGCACCACAT CCAAGTTTTC AAACACCATG TTCACTCTTA CCGTGAATTG CCAATCCGTA	2700
TCGCTGAAAT CGGTATGATG CACCGTTACG AAAAATCTGG TGCCCTCACT GGCCTTCAAC	2760
GTGTACGTGA AATGTCACTC AACGACGGTC ACCTATTCGT TACTCCAGAA CAAATCCAAG	2820
AAGAATTTCA ACGTGCCCTT CAGTTGATTA TCGATGTTTA TGAAGACTTC AACTTGACTG	2880
ACTACCGCTT CCGCTCTCT CTTCTGTACC CTCAAGATAC TCATAAGTAC TTTGATAACG	2940
ATGAGATGTG GGAAAAATGCC CAAACCATGC TTCGTGCAGC TCTTGATGAA ATGGGCGTGG	3000
ACTACTTTGA AGCCGAAGGT GAAGCAGCCT TCTACGGACC AAAATTGGAT ATCCAGATTA	3060
AAACTGCCCT TGAAAAAGAA GAAACCCTTT CTACTATCCA ACTTGATTTC TTGTTGCCAG	3120
AACGCTTCGA CCTCAAATAC ATCGGAGCTG ATGGCGAAGA TCACCGTCCA GTCATGATCC	3180
ACCGTGGGGT TATCTCAACT ATGGAACGCT TCACAGCTAT CTTGATTGAG AACTACAAGG	3240
GGGCCTTCCC AACATGGCTG GCACCACACC AAGTAACCCT CATCCAGTA TCTAACGAAA	3300
AACACGTGGA CTACGCTTGG GAAGTGGCCA AGAAACTCCG TGACCGCGGT GTCCGTGCAG	3360

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ACGTAGATGA GCGCAATGAA AAAATGCAGT TCAAGATCCG TGCTTCACAA ACCAGCAAGA	3420
TTCCTTACCA ATTAATTGTT GGAGACAAAG AAATGGAAGA CGAAACAGTC AACGTTGTC	3480
GCTACGGCCA AAAAGAAACA CAAACTGTCT CAGTTGATAA TTTTGTTCAA GCTATCCTAG	3540
CTGATATCGC CAACAAATCA CGCGTTGAGA AATAAGAGTC TAGCATAAAA GCCTCCAATC	3600
TGGAGGCTTT TTCTCATCTA TTTTACTCA AGGACTAAGT TCACTTGAGC AAACCTGAATC	3660
CGCACTGTCTG TTCCTTTTCC GACCTCAGAC TCGATACGAA TCTGGTGCCC CAGTTCTTCA	3720
GAAATTTTCT TAGATAGATA AAGGCCAAGT CCAGAGGACT GCTGGGTCAA ACGGCCATTG	3780
TATCTGAAA AGCCACGTC AAATACTCGG AGGACATCAC TGTTTTTTAT CCCGATTCCC	3840
GTATCTTGA TACAAAGCTC TTGGTCATCC ATATAAATCT CCAGACCACC TTCCTGGTG	3900
TACTTGAGAC TGTTTGAGAT GATTGCTCA ATAACCACTA GCAGCCACTT TTTATCCGTC	3960
ACGATTTCTT TATCAAGGTC ATGTAGATTG ACATTTAAGC CTTTTTGAAT AAAGAAAAGA	4020
GCATATTAC GAATTATTTT CTTGACCAAG TCCTCAATTT GAACCTGCTT TAAGACCAAA	4080
TCATCATGGA AACTTTCTAA ACGCAGGTAC TGTAAACTA GGTGGGTATA GGAGTCGATT	4140
TTGAAAATTT CCTGTTCTAG CTGCTGCTTC AGTTGGCGGT CGACCACTTC TGCAACTAAG	4200
AGTTGACTGG CTGCAATGGG GGTCTTTATC TGATGGACCC ACAAGGTATA GTAATCCAGC	4260
AAATCCGCTA GTTTTCTTTC TGCTTTTGAC CTCTGCTGAT AGAGTTCCAT CTCACGCGCT	4320
TCTAATTTT CTGCTAAAGC TATTTCCAAA GGAGACTTGG CTTCCTCTC TCCATAGAGA	4380
AGTTCTGGC GATAGACCTG CGTTTCCACC AATATGTCCC AAGTGA AAAA TAATATGGTT	4440
ACAAAGCAAC ACAAGAAGAA AAAGTAGAGG AAGTAAATTC CTAGACTGGC AAATAAAAAC	4500
TGAAAGAGTA AGACAAGAAA TGCCAAAGAA AGCAGATAGA TAAAAAGACG ACTACGGGAG	4560
CGCAGATAGG CTAGAAAAAA TTGTTTCCAA TCAAGCATGC TTCAATCCGT ACCCTATTCC	4620
TTTCTTGGTC TCGATAAATC CTACCAATCC CTGCTCCTCC AACTTTTAC GCAAACGAGC	4680
CACATTGACA GAGAGGGTAT TATCATCAAT GAAAAAGTCA CTGTTCCAAA GTTCCCGCAT	4740
CAGGTCGTCA CGTGCTACGA TGTGCTGTC ATGCTCAAAT AACACGCGTA AAATCTGGAA	4800
TTCATTCTTG GTCAAAATCA AGACTTGCCC TTGATAATGT AAATCCATGG ATTTGGTATT	4860
GAGGATAACA CCAGCATATT CCAGCAAACT CTCATCACGC CCAAACTCAT AGGAACGACG	4920
CAACAAGCCC TGAACCTTAG CTAAAAGAAC CTGCTGGTCA AAAGGCTTGG TCACAAAGTC	4980
ATCCGCCCC ATATTGATTG CCATGACAAT ATCCATAGCC TGGTCTCTCG AAGAAAGAAA	5040
CATGATAGGT ACCTTGAAA TCTTGCGGAT TTCCTGACAC CAGTGATAAC CATTAAACAA	5100
GGGCAACCA ATATCCATGA GGACCAGATG AGGTCCGAC TGAACAAATA GACTCAAAAC	5160



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ATCGTTGTTG GTGGGCCCAT TACTAGACCA AAAGAGATTA CAGAACGCTT CGTTGCTAGT	19260
CTTAAATAAG ATGTGAGGGG GAGTTTATG TTTAAAGTTT TACAAAAAGT TGGAAAAGCT	19320



TTTATGTTAC CTATAGCTAT ACTTCCTGCA GCAGGTCTAC TTTTGGGGAT TGGTGGTGCA	19380
CTTTCAAACC CAACCACGAT AGCAACTTAT CCAATACTAG ACAATAGTAT TTTTCAATCA	19440
ATATTCCAAG TAATGAGCTC TGCAGGAGAG GTTGTATTCA GTAATTTGTC ACTACTTCTC	19500
TGTGTGGGAT TATGTATTGG CTTAGCGAAA CGAGATAAAG GAACCGCTGC GTTAGCAGGA	19560
GTAAGTGGTT ACTTAGTTAT GACTGCAACG ATCAAAGCTT TGGTAAACT TTTTATGGCA	19620
GAAGGATCTG CAATTGATAC TGGAGTTATT GGAGCATTAG TTGTCGGAAT AGTTGCCGTA	19680
TATTTGCACA ACCGATATAA CAATATTCAA TTACCTTCCG CTTTAGGATT CTTTGGAGGT	19740
TCACGCTTCG TTCCTATTGT TACATCGTTC TCTTCTATCT TGATTGGCTT TGTCTTCTTT	19800
GTTATTTGGC CACCTTTCCA ACAACTTCTT GTTCTACAG GTGGATATAT TTCTCAGGCG	19860
GGTCCAATTG GAACTTTCT ATATGGATT TTAATGAGAC TTTCTGGAGC AGTAGGCTTA	19920
CATCATATAA TTTACCTAT GTTTGGTAT ACTGAACTG GTGGTGTGA AACTGTTGCA	19980
GGACAAACAG TGGTGGAGC TCAAAAAATA TTTTGTGCTC AATTAGCCGA TTTGGCCCAT	20040
TCTGGATTAT TTACAGAAGG AACAAAGTTT TTTGCAGGTC GTTCTCAAC AATGATGTTT	20100
GGTTTACCGG CTGCTGTTT AGCGATGTAC CATAGTGTTC CTAATAATCG TCGTAAAAAA	20160
TACGCGGTT TGTTTTGG AGTTGCTTTA ACATCTTTTA TTACCGGTAT TACAGAACCA	20220
ATTGAATTTA TGTTTCTATT CGTCAGTCCG GTTCTATATG TTGTTACGC ATTCCTTGAT	20280
GGTGTTAGCT TCTTTATGTC AGACGTCTTA AATATTTCAA TAGGAAACAC ATTTTCAGGA	20340
GGTGTAATCG ATTTCACTTT ATTTGGAATT TTGCAGGGA ACGCTAAGAC GAATGGGTT	20400
CTTCAGATTC CATTTGGACT TATTGGAGT GTTTGTATT ATATTATTTT TAGATGGTTC	20460
ATTACTCAAT TCAACGTCT AACGCCAGG CGAGGAGAAG AAGTAGATT TAAAGAAATT	20520
TCTGAATCCG CAGATTCAAC TTCAAATACT GCAGATTATT TAAACAGGA TAGCCTACAA	20580
ATTATCAGAG CCTTGGGTGG ATCAAATAAT ATAGAAGATG TAGATGCTTG TGTGACACGT	20640
TTACGTGTAG CTGTAAAAGA AGTTAATCAA GTTGATAAAG CACTTTTAAA ACAAAATTGGT	20700
GCAGTTGATG TCTTAGAAGT GAAGGTGGC ATTCAAGCAA TCTATGGAGC AAAAGCAATC	20760
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ATAAAAAACA GAGGAGAGTG ATGGATGAGT AGGATGAAAT GAAATCGCAT ACAAGAAATA	20880
AAGAACTCAT TATCCAAGTT GGATACGCTT ATTACATAGG AGAATACAAA TGAAATTTAG	20940
AAAATTAGCT TGTACAGTAC TTGCGGGTGC TGCAGTTCTT GGTCTTGCTG CTTGTGGCAA	21000
TTCTGGCGGA AGTAAAGATG CTGCCAAATC AGGTGGTGAC GGTGCCAAA CAGAAATCAC	21060

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TTGGTGGGCA TTCCCAGTAT TTACCCAAGA AAAAAGCTGGT GACGGTGTG GAACTTATGA	21120
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CATCGACTTC AAGTCAGGTC CTGAAAAAAT CACAACAGCC ATCGAAGCAG GAACAGCTCC	21240
AGACGTACTC TTTGATGCAC CAGGACGTAT CATCCAATAC GGTAAAAACG GTAAATTGGC	21300
TGAGTTGAAT GACCTCTTCA CAGATGAATT TGTAAAGAT GTCAACAATG AAAACATCGT	21360
ACAAGCAAGT AAAGCTGGAG ACAAGGCTTA TATGTATCCG ATTAGTTCTG CCCCATTCTA	21420
CATGGCAATG AACAAAGAAA TGTTAGAAGA TGCTGGAGTA GCAAACCTTG TAAAGAAGG	21480
TTGGACAACCT GATGATTTTG AAAAAGTATT GAAAGCACTT AAAGACAAGG GTTACACACC	21540
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CCTTTATAGC GGTCTGTAA CAGATGAAA AGTTAGCAA TATACAACCTG ATGATCCTAA	21660
ATTCGTCAAA GGTCTTGAAA AAGCAACTAG CTGGATTAAA GACAATTTGA TCAATAATGG	21720
TTCACAATTT GACGGTGGGG CAGATATCCA AAACCTTGCC AACGGTCAAA CATCTTACAC	21780
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AGAAGTGGA GAAGTACCAT TCCCATCAGA CGAAGTAAG CCAGCTCTTG AGTACCTTGT	21900
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TTTGAAAGCC TTCCTGAAA AAGCGAACGA AACAATCAAA AAAGCTATGA AACAATAGTC	22260
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CTCTACACAG ATAGTGTAAG AAAAGGGGGC TTTTGTTTAA AATGTAAGAA ACTGTCACGA	22380
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GTCTTTACAA AATCTCTGAT TAACACAGTT ATTTTGGTTA TTGGATCTGT ACCAGTTGTT	22740
GTTCTATTCT CACTCTTGT AGCATCTCAG ACCTATCATC AAAATGTCAT TGCCAGATCC	22800
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TGGAAATGGA TTTATGACCC ACTATCAGGG ATTCTAAACT TTGTCCTTAA GTCCAGCCAC	22920
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ATTATTCTCT TGACCACTTC AGTTGGTCAG CCCATCATCC TTTATATCGC TGCCATGGGG	23040
AATATTGACA ATTCACCTGGT TGAAGCGGCG CGTGTGTGATG GTGCAACTGA GTTCAAGTT	23100
TTTTGGAAGA TTAAATGGCC AAGCCTTCTT CCAACAACTC TTTATATTGC AATCATCACA	23160
ACAATTAACT CATTCAGTG TTTCGCCTTG ATTCAGCTTT TGACATCTGG TGGTCCAAAC	23220
TACTCAACAA GTACCTTGAT GTACTACCTT TACGAAAAG CCTTCCAATT GACAGAATAC	23280
GGCTATGCCA ACACAATTGG TGTCTTCTTG GCAGTCATGA TTGCTATCGT AAGCTTTGTT	23340
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CAACTCATGG TGCAGAACCC TGCCTTGCAA TGGATGTGGA ACTCAGTATT TATCTCATTG	23640
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CGTTTCTATG GTCAACGCAT TCTATTGCT ATCTTTATCG CTGCTATGGC GCTTCCAAA	23760
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AGTGAAAATA TCCCTACAGA GTTGCTTGAA TCAGCTAAAA TCGACGGTTG TGGTGAGATT	23940
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AGGGATTCAT CCTAATTTAG ACAAGGCTAT CGACTATCTC TACCAACATC GTAAGGATTC	24600

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TTTCGAATTA	GGAAAGTATG	ATATTGATGG	AGATAAAGTC	TTTCTAGTTG	TTCAGGAAAA	24660
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TTTGCTGGTA	GAAGGACATG	AATATTGAG	CTACGGTTCA	CGTATCAAAG	ACGAGGCAGT	24780
AGCATTGAC	GAAGCGAGTG	ACATTGGCTT	TGTTTCATTGT	CATGAACACT	ACCCACTCTT	24840
GTTGGGTTAT	CACAATTTTG	CGATTTTCTT	CCCAGGTGAG	CCACATCAGC	CAAATGGTTA	24900
TGCAGGCATG	GAAGAAAAGG	TTCGAAAATA	TCTCTTTAAA	ATTTTGATTG	ATTAAAAATA	24960
GGATGAATTG	TTTTTTTGTA	AAGCTTTGAT	AATACTCTAC	CATGAAATTG	ATCTTTGTGA	25020
GGTAGAGAAA	TGAGAATAAA	ATATTTAAAA	ATTGGTATCT	TCTAAGTATG	CTGCAAGAGC	25080
TAGTTTCTTA	GATGGACAGG	GGATTACAGT	TGATGAGATG	GCTTGGATAA	TTAGGGGCAT	25140
TGTGAATGCA	TTGATTGGTA	GATACATAAA	ATTAGGTACT	TATGCGGCTA	AGTATGGTAT	25200
TAGTATGGCA	CGCTCGATCT	TAAGTAGGGT	AGCTGCAACT	GCAGCAGCAA	GAGTAGGATT	25260
ACTGACCAAG	ATTTCTGGAT	GGATTTTACG	AGTAGCTGTG	AATGTAGCTG	ATGTATATGG	25320
TAATTTTGCC	AACAATATTG	CTGCAGCTTG	GGATGCATAT	GATAAAATTC	CTAACAATGG	25380
TCGTATAAAC	TTTTAAATG	CGAGAATGAA	AGCACTTTGT	ATTTTTTTAT	TGAATATGTT	25440
AGCTTGGACA	GTGCTTGCAA	TGATAATTCG	TGGAGGGCTA	GATGGATTGG	ATAGGCATAC	25500
TTGGAGTACT	ATTTTAATTG	CGTCGCTGTT	CGGGGTATAT	GATTATAAGC	CCATAGATAA	25560
AAATAGAAAA	AAGTCCAAAA	GAAAAAATAG	ATTTGTTTCT	GGTAGGGACT	TATGAAAGCT	25620
TTACTGACAA	AAAAGAAAAAC	AGTTTACAAA	GAAAAATGAT	GGAGGAGCAA	ACATGGCACA	25680
AAAAGGAGTA	AGCCTTATCA	AGGCAGCATT	TGATACAGAT	AACTTTCTCA	TGCGTTTCTAG	25740
TGAGAAGGTC	TTGGACATCG	TGACAGCCAA	TCTTCTTTT	GTCGTCTCTT	GTTTACCCAT	25800
CGTGACGATT	GGAGTGGCTA	AAATCAGCCT	CTACGAGACC	ATGTTGGAAG	TTAAGAAGAG	25860
CAGACGGGTG	CCTGTTTTTA	AAATCTATCT	AAGATCTTTC	AAGCAAAATC	TGAAACTAGG	25920
TCTTCAGCTG	GGTTTAATGG	AGTTAGGAAT	TGTGTTTCTT	ACCCTTTCAG	ATCTCTATCT	25980
TTTCTGGGGT	CAAACAGCTC	TGCCCTTCCA	ATTGCTGAAA	GCCATTTGTT	TAGGTATTCT	26040
GATTTTTCTT	ACTATCGTGA	TGCTGGCTAG	TTACCCTATC	GCGGCACGTT	ATGACCTATC	26100
TTGGAAAGAA	ATCTTCAAAA	AAGGATTGAT	GTTGGCTAGT	TTTAACTTTC	CTTGGTTCTT	26160
CCTCATGTTA	GCCATTCTTG	TCCTCATTGT	GATGGTTCTT	TATCTGTCCG	CCTTCAGTCT	26220
ACTCTTAGGT	GGCTCAGTCT	TCCTACTTTT	TGGGTTTGGA	CTATTGGTCT	TTATCCAGAC	26280
TGGATTGATG	GAGAAAATTT	TCGCAAAATA	CCAATAGGAG	CTTTATTCTT	GAAACTACTT	26340
TCAAAGGCTC	CAAACGCTAT	TCTATAAGCG	AGAAACTAAA	ATCGG		26385

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## (2) INFORMATION FOR SEQ ID NO: 4:

## (i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 2716 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: double
- (D) TOPOLOGY: linear

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO: 4:

CCTGCCCGCA TTGCCCTAGG CATTAAGTAA ACATATAAAA GCATGTGAGA GACTGTTGGA	60
AAAGCGAGGA AATTTCCCTT CTTTTCCTCT AGTCTCTCCT TTCTTTTGCT GATTTTATTC	120
AAAGAAAATG ATATAATAGT AGTTATGGAG AAAAAGAAAT TACGCATCAA TATGTTGAGT	180
TCAAGTGAGA AAGTAGCAGG ACAGGGAGTT TCAGGTGCTT ACCGTGAATT AGTTCGTCTT	240
CTTCACCGTG CTGCCAAGGA CCAATTGATT GTTACAGAAA ATCTTCCAAT CGAGGCAGAT	300
GTGACTCACT TTCATACGAT TGATTTTCCC TATTATTAT CAACCTTCCA AAAGAAACGC	360
TCAGGGAGAA AGATTGGCTA TGTGCATTTT TTGCCAGCTA CACTTGAGGG AAGTTTGAAA	420
ATTCCATTTT TCTTAAAGGG AATTGTGAAA CGCTATGTAT TTTCTTTTCA CAACCGGATG	480
GAGCACTTGG TTGTGGTCAA TCCTATGTTT ATTGAGGATT TGGTAGCAGC TGGTATTCCA	540
CGTGAAAAAG TGACCTATAT TCCTAACTTT GTCAACAAGG AAAAATGGCA TCCTCTACCA	600
CAAGAAGAGG TAGTCAGACT GCGCACAGAT CTTGGTCTTA GTGACAATCA GTTTATCGTA	660
GTAGGTGCTG GGCAAGTTCA GAAACGTAAA GGGATTGATG ACTTTATCCG TCTGGCTGAG	720
GAATTGCCCTC AGATTACCTT TATCTGGGCT GGTGGCTTCT CTTTGGTGG TATGACAGAT	780
GGTTATGAAC ACTATAAGAA AATTATGGAA AATCCCCCTA AAAATTGAT TTTCCAGGC	840
ATTGTATCGC CAGAGCGGAT GCGCGAATTG TATGCTCTAG CGGATCTTTT CTTGTGCTT	900
AGTTACAATG AGCTCTTTCC TATGACTATT TTAGAAGCTG CGAGTTGTGA GGCTCCTATT	960
ATGTTGCGTG ATTTAGATCT CTATAAGGTG ATTTTGAGAG GAAATTATCG GCGACAGCG	1020
GGTAGAGAAG AGATGAAAGA GGCTATTTTG GAATATCAAG CAAATCCTGC TGTCTTAAAA	1080
GATCTCAAAG AAAAGGCTAA GAATATTTCC AGAGAGTATT CTGAAGAGCA TCTGTTACAA	1140
ATCTGGTTGG ACTTTTATGA GAAACAAGCC GCTTTAGGGA GAAAGTAAAA AGTGAGGTAA	1200
TCTATGCGAA TTGGTTTATT TACAGATACC TATTTTCCTC AGGTTTCTGG TGTGCGACC	1260
AGTATTCGAA CCTTGAAAAC AGAACTTGAA AAGCAGGGAC ATGCTGTTTT TATCTTTACG	1320
ACGACAGATA AGGATGTCAA TCGCTACGAA GATTGGCAAA TTATCCGCAT TCCAAGTGTT	1380

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CCTTCTCTTG CTTTAAAGGA TCGTCGCTTT GCCTACCGAG GTTTTAGCAA GGCACCTGAA	1440
ATTGCTAAAC AGTATCAGCT AGATATTATC CATACTCAGA CAGAATTTTC TCTTGGCCTG	1500
TGCGGGATTT GGATTGCGCG TGAATTGAAA ATTCCAGTCA TCCATACCTA TCACACCCAG	1560
TATGAAGACT ATGTCCATTA TATTGCTAAG GGGATGTTGA TCCGGCCGAG TATGGTCAAG	1620
TATCTGGTTA GAGGTTTCCT GCATGATGTG GATGGGGTTA TTTGCCCTAG TGAGATTGTC	1680
CGTGACTTGC TATCTGATTA TAAGGTCAAG GTTGAAAAAC GGGTCATTCC TACTGGGATT	1740
GAATTAGCCA AGTTTGAGCG TCCGGAAATC AAGCAGGAAA ATTTGAAAGA ACTGCGTAGT	1800
AAACTAGGGA TTCAAGATGG TGAAAAGACG TTGCTTAGTC TTTGAGAAT CTCCTATGAA	1860
AAAAATATTC AAGCAGTTTT AGCAGCCTTT GCTGATGTTT TGAAAGAGGA AGACAAGGTT	1920
AAACTGGTAG TAGCTGGGA TGGCCCTTAT CTGAATGACC TCAAAGAGCA AGCCCAGAAC	1980
CTAGAGATTC AAGACTCAGT CATCTTTACA GGGATGATTG CTCCTAGTGA GACGGCTCTT	2040
TACTATAAAG CGGCGGATTT CTTCAATTCG GCATCGACAA GCGAAACGCA AGGTTTGACC	2100
TACTTGGAAG GCTTAGCCAG TGGAACACCT GTCATTGCTC ACGGAAATCC TTATTTGAAC	2160
AACCTCATCA GTGATAAAAT GTTTGGAACC TTGTACTATG GAGAACATGA TTTGGCTGGT	2220
GCTATTTTGG AAGCCCTGAT TGCAACACCA GACATGAACG AGCATACCTT ATCAGAGAAA	2280
TTGTATGAGA TTTCACTGA GAACTTTGGG AAACGAGTGC ATGAGTTTGA TCTGGATGCC	2340
ATTATTTCAA ATAACCTCCA GAAAGATTG GCTAAAGATG ATACGGTCAG TCAGCGTATC	2400
TTTAAGACAG TTTTGTATCT TCAGCAACAG GTGGTTGCTG TACCTGTAAA AGGATCTAGA	2460
CGCATGTTGA AGGCTTCAAA AACACAGTTG ATCAGTATGA GAGACTATTG GAAAGACCAT	2520
GAAGAATAGA AAGAGGAACA GCTATGAAAA AAACAATTAA TGAGAAGCGG TCGTGATAAA	2580
AAGATTGCGG GTGTTTGTGC TGGGGTGGCC CATTATCTGG ATATGGATCC GACTATCGTT	2640
CAAGTCATTT GGGGTGTTCT TACTTGCTGT TACGGAGCTG GAATTGTAGC TTACATTATT	2700
TTATGGATTA TCGCGA	2716

## (2) INFORMATION FOR SEQ ID NO: 5:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 13926 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO: 5:

CTTTGGTTTT GCCTTATTCA AGACATGAGG GCCATCAGGA ATGATCTGAA ACTGCGAATC	60
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TGTTAACAGT CTATGGAGAG CTTTCATAGA ACTAAGATTC GGTTCATCTT TGCTGCCACA	120
AATTAGTAAG GTTGGATAAG GGTAAGTTCC TGCTATATCC GTTAAATCAA GTGTCTTCAA	180
CTCCTCAGAA ACTCCGACCA TAAGAGTCTT GTCTGCTCCC TGTTTTTCAA ATACTCTTTT	240
GGGAAGTAGT TTAATAATCA GCAATTGAAG ATAAATAGG ATATCCCTG CTAATTAAAG	300
CGGGCATCCT GACAGAATCA AAGCTCGAAG ATTTGGTAAA TCGTAACTGG AAAGTTCTAG	360
TGTCAGGGCA GCACCTAAGG ACAATCCAAT CAAAACAAA GGTTCGTCT CTGAGCTAG	420
GTGCTGATAA ACTCGCTCTT TAGCTTGTG ATAGTTACTA ACTCCAGAAG GAAATAACTC	480
GATAGCCTCA GAAGGATAAT CTGTCAGTAG ATTCCGAAC TCTTTCCAAG ACTCTGCTGA	540
CTGCCCTAAC CCATGCAAAA ATATTAATTT CATCTAGTTC TCCTCAAGGC TTAATTCATA	600
CAAGCCTCTC ACTGCATTAC AGCCGTAAAT AGCTTCTGCT TGGGTTAAAT CTGCCAAGGT	660
CAAGACTTTC TCTTCTACCT GTCCTGTTTC TAGCAAATGC TGACGGTAAA TTCCTGGCAA	720
GATTCCAAGT CGGATAGGCG GTGTGTAGAG TTTCCAGCG ATTTTCAGAA CCAAATTTCC	780
TATAGAGGTT TCAAGCAGTT CTCCTGACTT ATTGTGGTAA ATCTTCTCTT GTTCTCCTAG	840
GCTCAAATGC GGTCCGTGAG TGGTTTAAA GTAGGTAAAG GATTGATTCA AAGCAGCTTC	900
CTGAAGACAG ACTTGGGCTT GACAAAAGCT TGTACTGAGA GGGGTTAATA CTTGACGATT	960
GACTTCTATC TCTCCAGATT TGCTAAGGCT GATTGCAAG CGGTAATCTC GATTAGCTTC	1020
ACAATCCTGA CACTCTTCCT CAATCTTG TGCCCAAGTCT TCTGCATCAA AAGGAAAAGC	1080
AAAATAACGA CTAGCTTTTC TCAGCCTTTC CAGATGTTGT TCTTCAAACA TCAGTTGTTT	1140
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TGCCTTTTGA TGAACCTCTC GGTATTCAGA TTCCCATGTG CTATCCCAAG TAATCCCTCC	1260
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AATCGTCTGT CCATTGGAA GCAAGAGACC AATCGTTCCA CAGTAGACTC CACGCGGTTG	1380
AGGCTCCAAG TCCTTGATAA TCTCCATTGT CGCAATTTTC GGTGCACCCG TTATGGAACC	1440
ACAAGGAAAG AGTGAGCGGA AGATTTCAAC AAGGTCCACA TCCTCTCGCA ACTGACTCTT	1500
GATGGTCGAA GTCATCTGCC AAACAGTTGA ATACTGCTCT ACCTGACACA GACGCTCCAC	1560
GTGCTCGCTC CCAACTTCAG AAATACGGTT CATATCATTG CGCAAGAGGT CCACAATCAT	1620
CATATTTTCA GAGCGATTTT TGGGATCCTG TTCCAACCAA CTGGCCTGTT CAAGATCTTC	1680
TTGGTCAGTT ACCCCACGCT GAGTCGTCCC CTTTATTGGT CGTGTGTGCA ACTCGCGATC	1740
ATTTTGCTCA AAAAAGAGCT CTGGGCTCAT GGAAATCACT GTCATCTCGT CATGTTCCAC	1800

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ATAGGCATTG TAGCCCGCCT CCTGCTCTAC CACCATACGA TTGTAGATGG CAAAAGGATT	1860
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TAAATGATGG TGAATTTGGG CAATGGCCTT TTCATAGTCT GCTGCAGACG TTACTTCCTG	1980
CCAATTTGAG GGCAATCAA TATCCTCATA AGTCAGAGGA ATAGGGGAAG TTTCTACGAT	2040
ATCATGAACA GTAAAGTAAA GCAGGTACTC TCCCAGTAGG GGATCCTTGT GAACTGCTAA	2100
TTTTTCCTCA AAAGCAGGTG CAGCCTCGTA GCTGACATAC CCCACCACAT AATAACCTTG	2160
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CAACTCTTTA ATAGGCTGGG TAAAGGTATA TCTCTCCCC AAAGTCCTAA AATCAATCAC	2280
TGTTTTTCTA TGCATACCTT AAGTATAGCA TAAAATAAGA AAACCCTCAT CCGCAAAGCA	2340
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TAAATCATCG TATGATGAAA CGGAAGAACC ATTTACTTCG AATGTTGTTA ATCCTTTCGT	2580
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GCTAATGCT TCGGGTTTAT AGATACCATT ACCTGGATTG CGATTAGTCA TTAATTGTTG	2940
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TCGAATTTTA TCCCATGAT TTAATTTATT GTTATCACGG TATTCTCTAT CTATTTTTTT	3060
GAACCATGCA CTATTTAAAT CTTTATTTTG TTGAGAAATC ACAGATTCAG CCTCAATTC	3120
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AATCGCACGG TCGTTGACGT GTGTTGTTTC ATGTGTGTAA ACTGAAATAC CGTATTCACC	3420
AACCATTCT AAATGAACAT ATTTTACATC AGTTCTAATA TCATCAGAGT TAGGATATAT	3480
AGCAGCATAA GCTCCTGTTT CATTATAATT ATAATACTTA TCCATAGGAC CAAAGAATTC	3540
TCTAAGAGGA GTATATACTT TGTCGGTATT ATAGCGGCCA TATTTTTCAA CCCATCCACC	3600



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AGGAGCGTTA TAACCTTCCC AAATAGGAAT AACAGCATCT CTTAGTAGTC GTTGTTTAAC	3660
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GAGTATAGTA TTTCTAAGGT GACTTCGTTT TAAATTATCG AATGCACGAT GTTTAGAATT	3900
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TAAATATAAA GGAAATTCCT GCTATAAAGG CCAGAGTTCG TAATAAACTA GTAAGTGAGA	13740
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AGACCGGTAA CAAAGGTAAG ATACAAGGAG AAAAGAAGGA TAGAATCCCT GCCAAAAAGA	13860
CACTTAGAAA AAAGAAAATA TGACCCATAA AGTTCTCTCT ATCATTTTAT TGATAGATT	13920
ATTATA	13926

## (2) INFORMATION FOR SEQ ID NO: 6:

## (i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 20199 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: double
- (D) TOPOLOGY: linear

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO: 6:

CCCAGCAGAA AAATGGCATT TGGAGATAAT GGAAATCGTA AAAAACTAT GTTTGAGAAA	60
ATAACCTTGT TTATCGTGAT TATCATGCTA GTAGCAAGTT TATTGGGAAT TTTTGCAACT	120
GCAATTGGTG CCCTCAGTAA TCTATAAAAT AGATTCAAGA AAATTTAGTG ACTGGGATTT	180
CCCAGCCCTT TTTTAAAGTG AGAAGAAATA ATGAGTATGT TTTTAGATAC AGCTAAGATT	240
AAGGTCAAGG CTGGTAATGG TGGCGATGGT ATGGTTGCCT TTCGTCGTGA AAAATATGTC	300
CCTAATGGAG GCCCTTGGGG TGGTGATGGT GGTCTGGAG GCAATGTGGT CTTCTGTGTA	360
GACGAAGGAC TACGTACCTT GATGGATTTC CGCTACAATC GTCATTTCAA GGCTGATTCT	420
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GTACCACAAG GTACGACTGT TCGTGATGCG GAGACTGGCA AGGTTTAAAC AGATTGATT	540
GAACATGGGC AAGAATTTAT CGTTGCCAC GGTGGTCGTG GTGGACGTGG AAATATTCGT	600
TTCGCGACAC CAAAAATCC TGCACCGGAA ATCTCTGAAA ATGGAGAACC AGGTCAGGAA	660
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GCAGTAGCCG ACTTGCCAGG TTTGATTGAA GGGGCTAGTC AAGGTGTTGG TTTGGGAAT	900
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CAGCTCCTTA CCCAGGCTTT GCAACTGATT TGCAACAACC GCTTACCCCT CTTTACTAA	3780
GAGCGAATGG TCGTGGTACA ATTGTCGATA CGATTACGA AAAACGTGTA AATCATGTTT	3840
TTGAACTAGC AAAGATGGAT GCGGATATTT CGACAACAAA TGGTCATATT TTGTACACGG	3900
GTGGACGTGA TTTACGTGGG GCCAGTGTTA AAGCGACCGA CTTAAGAGCT GGGGCTGCAC	3960
TAGTCATTGC TGGGCTTATG GCTGAAGGTA AAACGTAAAT TACCAATATC GAGTTTATCT	4020
TACGTGGTTA TTCTGATATT ATCGAAAAAT TACGTAATTT AGGAGCGGAT ATTAGACTTG	4080
TTGAGGATTA AACCGTAGAG GTGTTTATGA ATATTGGAC CAAATTAGCA ATGTTTCTT	4140
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GCGAGATAGC TTCAAATCCA GAAATCTTC AATTTATTTT CCCAACGCAG GCAAGTCTGG	4260
AAGAAAGTCA ATATGCACTG GCCAATTACT TTATGAAGTC CCCTTGGGA GTGTGGGCAA	4320
TTTGTGACCA GAAAAATCAA CAAATGATTG GTTCTATTAA ATTTGAGAAG TTAGATGAAA	4380
TCAAAAAAGA AGCTGAGCTT GGCTATTTTT TGAGAAAAGA TGCTTGGTCG CAAGGATTTA	4440
TGACAGAGGT TGTAGAAAA ATTTGTCAGC TTTCTTTTGA GGAATTTGGC TTAAACAAT	4500
TATTTATCAT TACCCACCTT GAAAATAAAG CTAGCCAAAG AGTTGCTCTT AAGTCTGGAT	4560
TTAGTTGTT CCGTCAGTTT AAGGGAAGTG ATCGTTACAC AAGAAAAATG CGGGATTATC	4620
TTGAATTTTC GTATGTAAAA GGAGAGTTCA ATGAGTAAGC ATCAGGAAAT TCTAAGCTAT	4680
TTGGAGGAAT TACCAGTAGG TAAAAGGGTC AGTGTTTCGT GCATTTTCGAA TCATCTAGGA	4740
GTTAGTGATG GAACAGCCTA TCGGGCTATT AAAGAAGCTG AAAACCGTGG AATTGTGGAG	4800
ACCCGCTCTA GAAGTGGAAC AATTCGTGTT AAATCCAGA AAGTTGCTAT AGAGAGATTA	4860
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GAGAGAGAAT TTAGTAAGTT TTCAATTGGT GCCATGACTG AACAAAATAT CTTGTCTTAC	4980
CTTCATGATG GGGGGCTCTT GATTGTGCGA GACCGAACCC GTATTCAAGT GCTAGCCTTG	5040
GAAAATGAAA ATGCAGTTCT GGTACAGGG GGATTTTTCAGG TTCATGATGA TGTGCTTAAA	5100
CTGGCCAATC AAAAAGGGAT TCCTGTTCTA AGAAGTAAGC ATGATACCTT TACCGTCGCG	5160

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ACCATGATCA ATAAAGCCTT GTCAAATGTC CAAATCAAGA CTGATATTCT GACAGTTGAG	5220
AAACTTTATC GCCCTAGTCA TGAGTATGGT TTTCTGAGAG AGACAGATAC AGTTAAAGAT	5280
TATTTGGACT TGGTTCGTAA GAATCGTAGC AGCCGTTTCC CTGTTATCAA TCAACATCAG	5340
GTCGTTGTTG GTGTTGTAAC CATGAGAGAC GCTGGTGATA AATCACCAAG CACGACAATT	5400
GATAAGGTTA TGTCTCGTAG TCTATTTTGG GTTGGATTAT CGACAAATAT TGCCAATGTG	5460
AGTCAACGGA TGATCGCAGA AGACTTTGAA ATGGTACCAG TTGTTCTGAAG CAATCAAACCT	5520
TTGCTTGGCG TTGTGACGCG ACGAGATGTC ATGGAGAAGA TGAGCCGTTT CCAAGTTTTCG	5580
GCTCTACCAA CTTTTTCTGA GCAGATTGGA CAAAAGCTCT CTTATCACCA TGATGAAGTA	5640
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AGTAAGGAAG AGAAGATGAA CGCATTATTA AATGGAATGA ATGACCGTCA GGCTGAGGCG	8220
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GAACGAACTA TTTTGGGGAC CATTTCGAAT GCTAAGAATG ATTTGATTGA TGATGTTGCT	8640
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CGTCTCTTTG	ATCAAAATCC	TGATGTTTTG	ACCTACTACC	AGCAAAAATT	CCAATACATC	8820
CACGTTGATG	AGTACCAAGA	TACCAACCAC	GCTCAGTACC	AATTGGTCAA	ACTCTTGGCT	8880
TCCCGTTTTA	AAAATATCTG	TGTGGTTGGG	GATGCGGACC	AGTCTATCTA	CGGTTGGCGT	8940
GGTGCTGATA	TGCAGAATAT	CTTGGACTTT	GAAAAGGATT	ACCCCAAAGC	CAAGGTTGTT	9000
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AAAAATAATA	AAAATCGCCG	TCCTAAAAAT	CTCTGGACTC	AAAACGCTGA	TGGGGAGCAA	9120
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GATGAACTTA	GTCGCAGTCA	AAACTTCCTT	CATAAGGATT	TGTCAGTTCT	CTATCGGACT	9240
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GGAAATGGTC	TAGGTACAGT	TGAGAAAATC	CGTGATTTTG	CAAATTTGCA	AAATATGTCT	9480
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GCGACTCTAG	AAAGCAAGGC	ACGGGTTGAA	AATATCGAAG	AGTTTCTTTC	TGTTACGAAG	9720
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GAAGAGCGCC	GTCTAGCCTA	TGTAGGTATC	ACGCGTGCAG	AGAAAATTCT	CTATCTGACC	10020
AATGCCAACT	CACGCTTGCT	TTTTGGTCGT	ACCAATTATA	ACCGTCCGAC	TCGTTTTATT	10080
AACGAAATCA	GTTCAGACTT	GCTTGAGTAT	CAAGGTCTGG	CTCGTCCTGC	AAATACAAGC	10140
TTTAAGGCAT	CATATAGCAG	TGGTAGTATT	TCCTTTGGTC	AAGGTATGAG	TTTGGCTCAG	10200
GCTCTTCAAG	ACCGTAAACG	CGGTGCTGCC	CCAAAATCAA	TCCAGTCAAG	CGGTCTTCCA	10260
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GCTAGGCAGG	AATTGAAAAT	CAATTTCCCA	GAAGTAGGTT	TGAAAAAACT	TTTAGCCAGT	10440
GTGGCTCCAA	TTGAGAAAAA	AATCTAATTT	TCCATCCTTC	TCACGAATAA	TAAAGTGAGG	10500

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ATTCTTCACT	ATGCAATCAA	GCATATGGCG	ACTTCTCTTA	TCTTGGTCCA	CAATCATCCT	11040
TCAGGAGCGG	TAGCGCCTAG	CCAAAATGAT	GATCATGTCA	CTAAACTTGT	TAAAGAAGCC	11100
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TCAACAGAAG	AATCCTGCCA	ATGGTCTTCG	ATATCTTGGT	ACAAAGTTCC	ACCCATGGCA	11520
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TGATTTTCGC	TTTCTAATCC	TCTTTTCGCA	TGAAGTAGAG	GAGGGTTTGG	AGTTCACTTG	11940
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TGAGAATTCC	TTTCACACCA	GCATCAACCA	AGAGATTAGC	AACCTCTTGT	GACTTGACGC	12060
TGGGAACAGT	TAGGATAGCA	GTCTTCACAT	CAGCATCCTT	GATTTTATCC	TTGATCTGAG	12120
AAATCCCGTA	AATGGGAATC	CCGTCAGGAG	TTTGGGTACC	GACTTCAGGA	TGGTCGTCTA	12180
GGTCAAAGGC	CATGATAATC	TTCATCTTGT	TACGTTCTGT	GAAGCGGTAG	TGGAGAAGGG	12240

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CATGGCCCAT	ATTTCCAATA	CCAACCAGCA	TGACATTGGT	AATAGAGTTG	TCATTGAGCA	12300
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CACCAAAATA	GGAAAAATCA	CGACGTACGG	TCGCTGAATC	AATACCGATA	GCCTCTGCAA	12420
TTTGCTTAGA	GTGGGACCGT	TCAATCTTTT	CTGCATGAAA	TCTCTTAAAA	ATTCGATAGT	12480
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CACAACCTTT	CTATTCTTCT	ATTTTATAGA	AACATTGTGA	AAAAATCAAC	AAAAATAAGA	12600
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TACTTGAGAG	TACGCTCTAC	ATGATAGCAG	TCCTTATAGG	TCAGTTCAAA	CATTTTGGCT	12840
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GTAATCGTAA	CGACAATTTT	TTAACTGAAT	GATTTTTTCA	AATGCCATAT	GGCTAACCTC	13200
CGATAATTTT	TTTAAAGGTT	TTTGCAGGGG	TTTGTAGGTC	TTCAACGGTA	TTTTGTGGCG	13260
ACAAACTGAT	GCGAAGGGAT	TCCTTCAAGC	GTTCTGAATT	TGCGCCATAC	ATGGCTTCAA	13320
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CAGCTAAATC	TAGCCGAAGG	AGTAAGAGGT	CATTTTCTCTG	ACCAGGAAAT	CCAATATTGA	13440
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TATTGTAATA AATGGTGTTC CCTTTGAACG TTTTCGTGGA GACGGGCTAA CAGTTTCGAC	17220
ACCGACTGGT AGTACTGCCT ATAACAAGTC TCTTGGCGGT GCTGTTTTAC ACCCTACCAT	17280
TGAAGCTTTG CAATTAACGG AAATTGCCAG CCTTAATAAT CGTGTCTATC GAACACTGGG	17340
CTCTTCCATT ATTGTGCCTA AGAAGGATAA GATTGAACTT ATTCCAACAA GAAACGATTA	17400
TCATACTATT TCGGTTGACA ATAGCGTTTA TTCTTCCGT AATATTGAGC GTATTGAGTA	17460
TCAAATCGAC CATCATAAGA TTCACTTTGT CGCGACTCCT AGCCATACCA GTTCTGGAA	17520
CCGTGTTAAG GACGCCTTTA TCGGCGAGGT GGATGAATGA GCTTTGAATT TATCGCAGAT	17580



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CTATTGGACG TTGGAGACTA CGTTACCATT GACATTCCCG CTGAGAAAGG CTTTGAAACC	17760
TTGGAGGCTA TTGAGCTTCC ATTAGATATT CTCTATGAGG ATGACCACTT TCTAGTCTTG	17820
AATAAACCTT ATGGAGTGGC TTCTATTCTT AGTGTCATC ACTCTAATAC CATTGCCAAT	17880
TTTATCAAGG GTTACTATGT CAAGCAAAAT TATGAAAATC AGCAGGTTCA CATGTGTACC	17940
AGACTAGATA GGGATACTTC TGGCTTGATG CTCTTTGCCA AGCACGGTTA TGCCCATGCA	18000
CGATTAGACA AGCAGTTGCA GAAGAAATCT ATCGAGAAAC GCTACTTTGC TTTGGTTAAG	18060
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TCCATTATTA CCAGACGAGT GGCTAAAGGC GGAAAGTATG CCCATACTTC ATACAAGATT	18180
GTAGCTTCTT ATGGAAATAT TCACCTGGTC TATATTCAAC TGCACACTGG TCGAACCCAT	18240
CAAATCCGAG TCCATTTTTC TCATATCGGT TTTCTTTGC TGGGAGATGA TTTGTATGGT	18300
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CATCCATTTT TAGAGCAAGA CTTGCAGTTA GAAAGTCCCT TGCCGGATGA TTTTAGTAAC	18420
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TTAAAGGAGA AAACCTCATGG AAGTTTTTGA AAGTCTCAA GCCAACCTTG TTGGTAAAAA	18540
TGCTCGTATC GTTCTCCCTG AAGGGGAAGA GCCTCGTATT CTTCAAGCAA CAAAACGCTT	18600
AGTAAAAGAA ACAGAAAGTA TTCCTGTTTT GCTTGGAAAT CCTGAAAAA TTAATAATTA	18660
TCTTGAAATT GAAGGAATCA TGGATGGTTA TGAGGTCATC GACCCTCAAC ATTATCCTCA	18720
ATTTGAAGAA ATGGTTTCTG CCTTGGTGGG GCGTCGCAAG GGCAAAATGA CTGAAGAAGA	18780
TGTACGCAAG GTTTTGGTTG AAGATGTCAA CTACTTTGGT GTGATGTTGG TTTACTTGGG	18840
CTTGGTTGAT GGAATGGTGT CAGGAGCGAT TCACTCAACA GCTTCAACAG TTCGCCCAGC	18900
TCTACAAATC ATCAAAACTC GTCCAAATGT AACTCGTACT TCAGGAGCCT TCCTCATGGT	18960
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AGCCTTGCTT GAAATTGCCA TCAACTCAGC AATCACAGCT AAGATGTTTG GCATCGAACC	19080
TAAAAATTGCC ATGTTGAGCT ATTCTACTAA AGGTTGAGG TTTGGTGAAA GCGTTGATAA	19140
GGTCGTTGAA GCAACTAAAA TTGCTCACGA CTTGCGTCTT GACCTTGAAA TCGATGGTGA	19200
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GGTAGCTGGT CAAGCAAAATG TCTTCATCTT CCCAGGTATC GAGGCAGGAA ATATTGGTTA	19320

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CAAGATGGCT GAACGCCTGG GTGGCTTTGC GGCTGTAGGA CCTGTTTTGC AAGGTTTAAA	19380
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TACTGTAGTT ATGAACTAT GTACGAAAAG CACTGCCATT AATTCCTGAG AACTAAATTA	19560
CTGATTGGTG TCAAAAAGGA AACTTCCAA GCGATGATAT CCTGCTATA CACGACCTAT	19620
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GAGAAAGGAC AAATTCATC CTCTCTTTT TGATATTCAG AGCGATAAAA ATCCGTTTTT	19800
TGAAGTTTTT AAAGTTCCGA AAACCAAAGG CATTCGCTT GATAAGTTTG ATGAGATTAT	19860
TGGTCGCTTC CAGTTTGGCG TTAGAATAGT GTAGTTGAAG GCGTTGATA ATCTTTCTCT	19920
TATCTTTGAG GAAGGTTTTA AAGACAGTCT GAAAAATAGG ATGAACCTGC TTAAGATTGT	19980
CCTCAATAAG TCCGAAAAAT TTCTCTGGTT CCTTATTCTG GAAGTAAAA AGCAAGAGTT	20040
GATAGAGCTG ATAGTGGTGT TTCAAGTCTT CCGAATAGCT CAAAAGCTTG TTTAAATCT	20100
CTTTATTGGT TAAGTGATA CGAAAAATAG GACGATAAAA TCGCTTATCA CTCAGTTTAC	20160
GGCTATCCTG TTGAATGAGT TTCCAGTAGC GCTTGATAG	20199

(2) INFORMATION FOR SEQ ID NO: 7:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 19702 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 7:

ACCCGATGTA TCAGCGGATA TTTACTCTAT TTTTCAAACG ATGTTATACC CACAATAAAA	60
GAAAAAAGAC CCTAAGGTCT CCTTTGCTTT TATTATTAAA CGCGTTCAAC TTTACCTGAT	120
TTCAAAGCAC GAGCTGAAGC CCAAACTTT TTAGGTTTAC CATCGATAAG AACAGTAACT	180
TTTTGAAGT TTGGTTTTAC GGCACGTTT GTTTGGTTCA TCGCGTGTGA ACGGTTGTTT	240
CCTGATACAG TCTTACGACC TGTAAGTAA CATACTTTAG CCATTGTGTT TTCTCTCTAT	300
TAGATCTAAT ATAGCGGATG TGCTAGCACC ACATACCGTA CTATGTTATC ACATTTTCTT	360
GTTTTTTGCA AGGGAATTGG AAGATTTTTT ATTTGTGTCT TAAATCAGGT CTTGCGTGAC	420
ATTTCTGCTC TCCACATGCC ATCGTTGATT AACAGAACAC CAGAATTAAA ATTATGTGTA	480
TAAAAATCAT CTCTAACTGC AGCTAAGGT ATAGCCGTCA AGTCCAAATC CCACAGCTCA	540

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TCTATCGATT TTCTTACAAC AATATCTGAA TCCAAATACA GTACACGAGA CTCGCTTACA	600
TACTTTGGAA TAAATACCT AAAAAGCCG CATATGAAAG TCCCTCAAAG GGGAGACGAT	660
AACCTTTCAG AATATTACTG TCAATCTAAA CATTACAAT CTCACTATTC AAAGTCTCTA	720
GTCTTTTTC CATCAATTGG AACCATTCCT GCGGAAGGTC ATCATTAAAA ACATAAAACT	780
TAAGATTATA ATGATGAACA CAAAGAGATT TTATTGTTGT TTCAACTTTA TCCATATAAG	840
CATTATCTGC ACCTAAGACA ATCGCTTTT TCTCTCTTT CACTTTTAT CTCATTTCTT	900
TTTATTTCCA TCATATTATT CCCATCATAT GTTCCCATC ATATGTTTCT ACGTAACCAT	960
TATTTTCGCC TATTCGTTTCG TAAACCATTA CCAAGTGGAGA TTTTAGATGA AGTCCCATTA	1020
CGGTTTACAA TTTTACATT ACGACACGGA GTTTTACAAA TCGATTTCAT TTGCCAAACG	1080
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CCATGCGGTG TTTAAAGACT TCAAACTGGA GTTGACCTAC AGCGCCTAGC ATGTACTCAC	1440
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CCTGATAAGT ACCGGTATCG TAAACCCCGA TAATATCACC TGCCACGGCA TTGGTCACAT	1680
TCTCAGACT CTCCGCCATA AACTGGGTAA CATTAGATAG TTTAGCCCC TTACCAGTAC	1740
GAGGGAGATT GACACTCATG CCGCGCTCAA ATTCGCCAGA TACGATACGG ACAAAGGCAA	1800
TACGGTCACG GTGACGAGG TCCATGTTGG CTTGGATTTT AAAGACAAAG CCTGAGAAAT	1860
CCTTGTGATA AGGATCCACA ATTTACCGT CTGTTTCTT GTGACCATGT GGTTCCTGGAG	1920
CAAACCTGAG GAAGGTTTCA AGGAAGGTCT GCACACCAA GTTTGTCAGG GCTGAACCGA	1980
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CATTTAAAAG CTCAATGTCA TCCTTGACTT GCTCGTAGAA AGGATTGCTA CCAAAGAGTT	2100
TGTCCCCGTC TTCTAGACTG GCAAAACGCT CATCCCCCTT GTAAAGCTCT AAACGTTGGT	2160
TATAGAGGTC ATACAAGCCC TCAAAGGCTT TCCCCATCCC GATAGGCCAG TTCATAGGTT	2220
AGCTAGCAAT GCCCAAGATT TCTTCCAATT CTTGCAAGAG ATCCAAAGGC TCACGACCGT	2280

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CACGGTCCAG CTTGTTTATA AAGGTAAAGA CTGGAATGCC ACGATGTTTC ACAACCTCAA	2340
ACAATTTCCTT GGTGAGGCC TCGATCCCCT TGGCAGAGTC CACGACCATG ACCGCAGCAT	2400
CCACCGCCAT CAAGGTACGA TAGGTATCTT CTGAGAAGTC CTCGTGCCCT GCGGTGTCTA	2460
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CACGTGTGCTT CTCGATATCC ATCCAGTCAG ATTTAGCAA AGTCCCTGTT TTCTTCCCTT	2580
TTACCGTACC AGCCTCACGA ATCTCACCCC CAAAGTAGAG TAACTGCTCA GTGATGGTTG	2640
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GAGGTAACAC ACGTTGCCAA TCTTTCAAAA TTAAGATTCT CTGAAGAAGA AACTGCTGCC	3000
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ACTGGTGTG CACCTACTAC GACTATGGCT GACCGCAAGA CTGTACTCCG CCTGATGTG	3120
GCCGAAGAAG GAATAGACCG TGATCGCTTG TTTAAAAACG TACCTGAAAA AGACAACTAC	3180
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ACAATGTCCT TTCAGGAATT CCACTTGCTG TTAAGGATAA CATCTCTACA GACGGTATTC	3480
TCACAACTGC TGCCCTCAAAA ATGCTCTACA ACTATGAGCC AATCTTTGAT GCGACAGCTG	3540
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AGGTAAAACA CTGGAACAAA TCGAATTGAC ACCAGAAAAC TTGGTTGAAA TGATTGCCAT	5820

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AAAGAAAAC AGACAGAACA AAACCAGCCC TAAGGTTGGT TTTTCTTCT CTACCAACTC	6180
CCAATAACTA TTTTGGCTTT ATTTCAGAG TATTTTATGG TAAATGAAG AGTAATAATA	6240
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AGCCATGTC TAATAGGAAT TCTGCCTTTT GGAAATCCTC AGGCAAGCTT TCACGAACCG	11160



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TATCGCCTTC CATAGCGAAA GAAGCTGTCA CACCACCAGT CGTTGGATCT GTCAAAATGG	11280
TCAGGTAAAA GAGACCAGCA TTTGAATGGC GTTTAACC GC CAGAGATC TTAGCCATCT	11340
GCATGAGACT CATGATTCTT TCCTGCATAC GGGCTCCACC AGAGGCTGTG AATAGGACAA	11400
CTGGCAATTT TTCGACAGTC GCATACTCAA ACAAACGAGT GATTTTTTCA CCTACAACCG	11460
TACCCATAGA AGCCATGATA AAGTTAGAAT CCATAATCCC AAGAGCCACA GTCTGACCTT	11520
TAATAAGAGC AGTTCTGTGC ACAACGGCTT CATGCAGACC TGTTTTTTCA CGCATAGATG	11580
CCAGTTTCTT TTGTAACCA GGGAAATGCA AGGGATCCTT GCTTTCAATC CCTGTAAACA	11640
ATTCTTTGAA GGTTCCTATA TCAATCGTCA AAGCCAAGCG TTCTTGGGCA GAAATACGAA	11700
AGGTATAGCT ACAGTCCGGA CAGATACGTT CACTTCCAG ATCCTTCTGA TAGATGGTAT	11760
GCTTACAGCC TGGACACTGG GAAATAAATT CATCTGGAAC CTCTGGCTTA GCTTGAGGTT	11820
TTTCCCTAAC CGAACGATTG GGATTGATTC GAATATACTT ATCTTTTITA CTAAATAGAG	11880
CCATTGATTC CCTTTTTCGG TTAAACTCT TAAAGTCATT TTATTCTTTT TCTTGATATT	11940
TAGGTAAGAA GGTTCCTATC AAGAAGGAAG TATCATAATC CCCAGCAATG ACATTGCGAT	12000
CTGAAATGAG GTCAAGCTGG AAATCTGCAT TGGTCTGCAC TCCTTCAATT TCTAATTCAT	12060
AGAGGGCAGC TTGCATTTTC ATCAAGGCGT CAAAACGATT TTCGCCGTGT ACTATGATTT	12120
TGGCAATCAT ACTATCATAA TAAGGCGGAA TGGTATAACC TGGATAAACT GCTGAATCCA	12180
CGCGCAAGCC AACTCCACCA CTTGGCAGAT AGAGATTAGT AATCTTACCT GGAATTGGAG	12240
CAAAGTTAAA GGCTGGGTTT TCTGCATTGA TACGACACTC GATGGCATGA CCGCGTAGGA	12300
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AACAATCCCG TTCACCCAAG TGAATCACAT GTCCATGCTC ATCACCTAGG ATTTGAACCT	12660
CAATGTGCCG AGCTGGATAG ATAACCCGTT CTATGTACAT GGCACCATG CCATAATTGG	12720
CCTTGGCCTC ACTAGAGGCA GTTTCAAAGG CAGAAACGAG GTCATCTGGT TTTTCAACCT	12780
TACGAATCCC TTTACCACCT CCACCTGCTG AAGCCTTGAG CATAACAGGA TAGCCAATTT	12840
TTTCAGCAAC AATCAAAGCT TCTTCAGAGT TATGCACTTC TCCATCTGAA CCTGGTATAA	12900

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CAGCTGATAG	AACTGCATTA	ATATTGAGAT	AAGACTCTGT	TGCCTTGCCA	GGACCAATAC	13140
AAACTGCTTC	ATCTGCCAAA	AGCGTATGAA	GAGCTTCCTT	ATCAGCAGTT	GAATAAACCG	13200
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GAGTTGACGT	TCCGTGAGCA	TTGACATAGG	CTACTTGCTC	TGGAGAAATC	TCAGCTTCTT	14580
CCAAGGCTAG	TTTGATGGCC	TTGATAGCTC	CCTGACCTTC	TGGATGTGGA	GAAGTCATGT	14640
GGTAGGCATC	ACAAGTATTT	CCGTAACCAA	CCACTTCAGC	CAGGATAGTA	GCTCCACGTT	14700

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CATTGCGATC CTTATCAAAT GGGATCGAAG CACGAGTTGG ATCCTCTGTA GTAGAGAGAG	14820
CTGTAAAGGC TTGGAAACCA GCGATGGCAA AAGGTGTGAT AGAAGCTTCT GTTCCTCCCA	14880
CCAACATCAC ATCTTGGAAA CCAAACCTAA TGGAGCGGAA GGCATCCCCA ATCGCATCAT	14940
TTGATGAAGA GCAGGCAGTA TTGATAGATT TACAAACACC GTTTGCACCA AAACGCATGG	15000
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GATTTACAGC CTCTGGGCT GCATACAAGG CATATAAAGA ATAGTTATCA AAACGGTTGG	15240
TATCTTTTTT TACAAAGTAT TTATCGAACG GAAAATCTTG GATTTCTGCC GCATTATGCA	15300
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AACTATTCCA AAATCTTCT GGTGTATTTT CGATTGGAGA TGTTACTCCA TAACCTGTTA	15420
CCACTACTCG ATTTAGTTTC ATTCTTTTCA CCTCTAGCTT TCGCTACATA CTTAAGCCAC	15480
CATCAATGGC AACCACCTGT CCAGTTAGAT AATCTTGGCC TGCTAAAAAT ACTGTCAAAT	15540
CTGCAACCTG CTCTGCCTGC CCAAATCTT TCATCGGAAT CTGAGCTAGT GTAGCTTCCT	15600
TAATCTTATC TGACAGGATA GCGGTCATAT CAGACTCAAT CATTCCTGGA GCAATCACAT	15660
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TCCTTTCAAA ACTTCTACTT ATTTTAGTCT ATTTTCTAA AAGTGCTACT AAACCTGCTT	16260
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TTTCATAGAA ACGAACGGGT TCCTTGACCT GACGCGTCAA GAGCTGAGCA ATGTCTCTTT	16440

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GCGTATTGAG AACTGCTACC ATCTTGCCAG AGTCAGCAGG AGCCGCTTCT TCCATATAGG	16800
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GCCGCAGCAC CTTCAACATC CGCAATTCCT CCTGCAGCAA TAACAGGAAT AGATATAGCT	17640
GTGGCTACCT GTCGCACCAA GGTCATGGTT GTTAATTTAC CGATATGCCC CCCAGCTTCC	17700
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CCTCCTTGA AATAGGATA ATCAATCTTC AATAATCTG TAATACGGT TTTCATAGTG	18120
CCTCCAACCT TCCTTGCTTA CGTAATAGTT CGATTTTACC ATAATTTGAC AGTCAAACTA	18180
TTACCTAAAC AAGAGGGAGT GGGTTTCTCC CTACTCCTC TACTAATATT CTGCTTATTT	18240

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TGCTTGCTCT TCAACGTAAG CAACCAAGTC ACCAACTGTT TTCAAGTCAT TTTCTGCTTC	18300
GATTTGGATA TCAAAAGCAT CTTCGATTTT TGAGATTACT TGGAACAAGT CCAATGAATC	18360
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ATAGTTTTTT TATAACAATG TGTTCAACAC ATGATTACCT AAATTGTAAG AATGAGCGTG	18540
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ACCACTTGCT CTGGCACATA ATGAGCAACC TGACTTATTT TTGCAAAAGC CATTATTTCA	19500
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CGCTCATGCC ATCAATAATT TTTTCTACCA TGGCCTTGTG GAAGCGTTTA TGCAGTCTAT	19620
GAATCAAGCG ACCCTTCTTT GTCAAATGCA GATGCACCAC ACGACGATCC TGTCTGACC	19680
GAACTCGCTC AATGTAGCCC GG	19702

(2) INFORMATION FOR SEQ ID NO: 8:

- (i) SEQUENCE CHARACTERISTICS:
  - (A) LENGTH: 6211 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

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(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 8:

GAAAATTTC TCTCTTCTCT TGAAAAATTT TGAAAAAATG GTATGATAGT AACAAAGTTAT	60
TTTTAAGAGG AAAGAAAGGG GAATAATGGA GAAATCAGT TTAGAATCTC CTAAGACGGG	120
GTCCGACCTA GTTTTGGAAA CACTTCGTGA TTTAGGAGTT GATACCATCT TGGTTATCC	180
TGGTGGTGCG GTTTTGCCTT TTTATGATGC GATATATAAT TTTAAAGGCA TTCGCCACAT	240
TCTAGGGCGC CATGAGCAAG GTTGTTCGCA TGAAGCTGAA GGTATGCCA AATCAACTGG	300
AAAGTTGGGT GTTGCCGTCG TCACTAGTGG ACCAGGAGCA ACAAATGCCA TTACAGGGAT	360
TGCGGATGCC ATGAGCGATA CCGTTCCTT TTTGGTCTTT ACAGGTCAGG TGGCGCGAGC	420
AGGGATTGGG AAGGATGCCT TTCAGGAGGC AGACATCGTG GGAATTACCA TGCCAATCAC	480
TAAGTACAAT TACCAAGTTC GTGAGACAGC TGATATCCG CGTATCATTA CGGAAGCTGT	540
CCATATCGCA ACTACAGGCC GTCCAGGGCC AGTTGTAATT GACCTACCAA AAGACATATC	600
TGCTTTAGAA ACAGACTTCA TTTATTCACC AGAAGTGAAT TTACCAAGTT ATCAGCCGAC	660
TCTTGAGCCG AATGATATGC AAATCAAGAA AATCTTGAAG CAATTGTCCA AGGCTAAAAA	720
GCCAGTCTTG TTAGCTGGTG GTGGAATTAG TTATGCTGAG GCTGCTACGG AACTAAATGA	780
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TGAGATTGGC AAGATTATCA GTGCAGACAT TCCTGTAGTT GGAGATGCTA AGAAGGCCTT	1080
GCAAATGTTG CTAGCAGAAC CAACAGTTCA CAACAACACT GAAAAGTGGA TTGAGAAAGT	1140
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CTATAAGTTT GACAATCCTG AGACCTTGGC TCAAGACCTT GAAGTCATCA CTGAGGATGT	1680

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TGGTAAGAGT AATCATGAGA TGTGGGGGT GCAGTTCCAT GCGTAGAATG TTAACAGCAA	1800
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TTATTATTGA TGTGCTTCT CATGATGAAG TGGAGCAAAT CATCAAACAG CTCAATCGTC	1980
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CGTTGGTAAA AACGACGATG ATGCATTCAA AATCTATAAC TAATTAGAAA TATATAGCGC	3360
TGGAGATGAT TTTATGAAAA AGATTATGAG AAAAAATTGCA TCGTTATTAT TGGTTCTAGT	3420

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TGTATAATGT AATTACACCG TCGGTAATAG TGCTAGCAGA CCAAAATAAA GCAGATTGGT	3480
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GGATTTTGAG AAATAAAAAA CATTAACAAA TATAGTTGGT AAATCATTAG GACCTAAATC	3720
AGCTGTTAGA TTCGGAGAAG CTTTATCCTA TATTGAAGGT CCTCTTCGCA GAATAAATGA	3780
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GCTGCCTTTG AGGCTGGAGG TCCAGTAAA CTCAAGGAAA TTGATAAATT TGCTGATGGG	5040
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TTGGTAGGTG TCGATGAGG ATTGATTTCT GAAACCTTGA TTGACCTTA CTCTAAGCAA	5160
GGGATAGTCG CAGAACCTGC TGGAGCGGCT AGTATCGCCT CTTTAGAGGT TTTAGCTGAA	5220



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TATATTAAGG GGAAAACCAT TTGTTGTATC ATTTCTGGAG GAAATAATGA TATCAACCGT	5280
ATGCCAGAAA TGGAAGAGCG TGCCTTGATT TATGATGGTA TCAAACATTA CTTTGTGGTC	5340
AATTTCCAC AACGTCCAGG AGCTTTGCGT GAGTTTGTA ATGATATCCT GGGGCCAAAT	5400
GATGATATCA CACGTTTGA GTATATCAAA CGAGCTAGCA AGGGAACAGG CCCAGTATTA	5460
ATTGGGATCG CTTTAGCAGA TAAGCATGAT TATGCAGGTT TGATTCTAG AATGGAAGGT	5520
TTTGATCCAG CTTATATTAA CTAAATGGT AATGAAACGC TTTATAATAT GCTTGTCTGA	5580
GGACTAATAA AAAAATATCA TACCTTCATT TTGATTTCCT ATCTATTGAC AAGCATAGTC	5640
ACACTGTCTT TAATACTCTT CGAAAATCTC TTCAAACAC GTTAGCTCTA TCTGCAACCT	5700
CAAAACAGTG TTTTGAGCAA CTGCGGCTA GCTTCCTAGT TTGCTCTTG ATTTTCATTG	5760
AGTATAAGGT ATGATTGAT TTCTTTTGT TGACAAATAT ACTATATTAA AAAGATATAT	5820
AAGTAATTAA CTGAGCTTAT CTGCTTGTG ATCTCTATTA AGGATGGTTT AGATAATCGG	5880
GTGCTGCTT CTAGGCTAGC ACCTCAATAT CCAAAGGAGT GATGAATTG AAGGACATAA	5940
GGAATACCTA TCTCTCAGAT GATTTATTGA GGAAGAAAGA TAGGAGTTT TGAGCTAGTG	6000
AAGGCTTGA TTTCTAAAG TTAGAATAT CATCTTCAGT TCTTAAATCG AAGAAATAAG	6060
CTATCTTACG GAAATAGAGA AGCATTTTT AAGAACTTGA ATAATTTCGC ACCTTAAGAG	6120
GGTAATAATA CAGTATTTTT ATTAGCAAAT ATTTATGGTG TAGAGGCTAG CAAAACCTAT	6180
ATATTATCGG ATTTAAAAG GAAGTAAGAA A	6211

## (2) INFORMATION FOR SEQ ID NO: 9:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 7939 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO: 9:

CCGACTCCC CACGATTCTT CAAATAACT GAGTATATTT CTATCTTGAT TTCAGATAT	60
AAATTCTTCC TTCTGTGGCC TCTTCTTACG CTTGAGAAGA GCTTCTCCGA CATGGCTTCT	120
TCCTTACTGA GCAAAACCTT GAGCATAGAT AAGTTTGA CTGCAAGCGTG CTCTGTATA	180
TTTGGCTCCC TTCCCACTAT TGTGGATAGC GAGGCGTCTT CTCATATCAG TCGTATAGCC	240
TATATAGTAG GATCCATCAC GAACTCCAG AACGTACATA TAAGCCTTAT GATCCATAAT	300
AAATCTCTTC GATTTCTGGC GTATAAGAGC CATCATCAT GTGGACAATC AAAGGAGGTA	360

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AGACCTTAAA GCCACTTGTT GAGCCATCCT TGATCGCCTC AATCAAAAGC ATATTGGCTT	420
CCTTTTCTCT TTTTGGATAA ACAAAC TGCA GGCGCTTAGG GGCTAGATTA TGTCGTTTTA	480
ACGTATCCAA AATATCCAGA AGTCGATCAG GACGATGAAC CATGGCCAAA CGCCCATTAG	540
ACTTGAGAAT ACTCTGGGCA CTACGACAGA TTTCTTCCAA ATTAGTCGTG ATTTCTGTGC	600
GAGCCAAGAG ATAATGTTCA CTCTCGTTCA GATTAGAATA AGGATTCAAC TTGAAATAGG	660
GTGGATTACA CAAAATCATA TCCACCTTAC TCCCCTGAAT GTGAGCAGGC ATATTTTTC	720
AATCATCGCA GATGACCTGC ATTTGCTCCT CTAATCCATT CAAACGGACA GAGCGTTCAG	780
CCATATCCGC CAAACGCTCC TGAATCTCAA CAGACAATAT CTGTGCTTGA GTACGAGTGC	840
TAGCAAAAAG CCCCACTGCT CCATTCCCAG CACAGAAATC CACAATCAAC CCCTTCTTAG	900
GAAACGTGG AAATCGTGAT AAGAGAACAC TATCCACCGA ATAGCTAAAA ACCTCTCTAT	960
TTTGAATGAT TTTGATATCT GTCGAAAAGA GCTGGTTAAT GCGCTCTCCT GATTTTAATA	1020
ATTGTTCTTC TTCCATGGTC CTATTATAGC AAATTCATAT TAACATTACA AAAAATATAA	1080
AACTCTAAAC TACTTCTTCT TTTTAAATG GTGCAGGGCT TCTCCAGTCC AGATTGGTAG	1140
CATTCTCGTA AAGGGAGCAA AGCCGTAGTT AAAGCGGTCG CTGAAAAGC GTCTCCGTCT	1200
AGGAAACTGG TACTTTTCTT CCTCCAAAGT GCGGATAGAA AGACTGGCTT TCCCTGTAAA	1260
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ATTTTCAATA AATCCTGTCC GAATCTCTGA AATGTGAATC AGCCCCGTAT CACCCGTCTC	1380
TAATCAACA AAGGCACCGT AGGGCTGAAT CCCTGTAATA CGCCCCTTTA GCTTATCACC	1440
GATTTTCATC TTAGTCCTCG ATTTCAATAG TTTCAATTAC AACATCTTCA ACTGGCTTGT	1500
CCATAGCTCC TGTCTCAACA GCAGCAATGG CATCCAAGAC AGCGTAAGAT GCTTCATCAG	1560
CTAACTGACC AAAAACCGTG TGACGGCGGT CTAGGTGAGG TGTCACCTT TGATTGGCAT	1620
AGATTTCTGC AATCGGTTCT GGCCAACCAC CACGAGTAAT TTCTTTCTTA GAATAAGGTA	1680
GGTGTGGTT TTGCACGATA AAGAACTGGC TGCCGTTGGT ATTTGGACCA GCATTTGCCA	1740
TGAAAGAGC ACCACGATA TTGTAAAGCT CTTCTGAGAA TTCATCCTCA AAAGATTGCG	1800
CGTAGATTGA CTCGCCACCC ATACCACTTC CAGTTGGGTC TCCACCTTGG ATCATAAAGT	1860
CCTTGATAAT ACGGTGGAAT ATGACACCAT CATAGTAGCC ATCTTTTGAA AGAGATACAA	1920
AGTTAGCCAC TGTTTTAGGA GCATGTTTCA GGAAGAGCTT GATACGTAAG TCTCCGTGAT	1980
TGGTCTTAAT AGTCGCAAGA GGACCTTCTA CTGTTTCAAT GTCTACTTGT GGAAAATGCA	2040
ATTCCTTTTC TACCATACCA AATACTTCTA AGGCAGCAAA AATGCCATCT TCTTCTAATG	2100
TTTTTGTAAT ATAATCTGCT TTTTCTTGA TTTTATCATG AGAAATTCCT ATGGCAACGC	2160

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AAATCGGCAC AATATCAGAC GAATGTTGAT GCCAACGAAC CATGCGAAGT TTGTCTGAGA	2340
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CTTCTTTTTC ATGGAAATCG GGATCTACAT CTAAGTCGGG ATAAATTGGA TTGATAGCTT	2460
CACTCATCAT ATCGGTGCGA GTCGACAACT TGGCATCATG ACTCCCAACC AAGCCATACT	2520
CAATTCCTTC TTGCTTAGCC CAAGAGATAT ACTCCTCAAC ATCTGACTTT TCAATCTGAT	2580
GCTGATAAAT GACCTGACCT TTTTATCTT CGATATAAGC CCCATTCAAA GTTACAAAAA	2640
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TCTTTGCCTT GTATCTTAAT TTCGCGTCCA TCTCACTACC TCTTCAATC TAACTCTTC	2880
CATTATATCA TAAAGTAGGC AAATCCCCTA TTTTCAAAAA GTTTATCATT TTTATTTTAA	2940
TTTCTTGGAT GAGAAAAGAG ACATATTTAT GAAAAGCTC CATCGTGCTT TTAATGTGTT	3000
CTCTGTGTTT CAAACTCGTA AAAAGGGAGC CACTGATCCT AACTCGCTCT CTCATTTCAA	3060
AGCTTGTGAA AAAAGACCCG TTGGGGTCTT AATTCGCTTT CTGTGTTTCA AGCTCATGAA	3120
AAAGAGACCC AACTGGGTCT TTTCTTTAAT CTTCGTTTAC GAAAGGCATC AAAGCCATTA	3180
CGCGAGCGCG TTTGATAGCT GTTGTTACTT TACGTTGGTT TTTAGCTGAA GTTCCTGTTA	3240
CACGACGAGG AAGGATTTTC CCACGTTCTG AAACGAAACG GCTAAGAAGC TCAGTATCTT	3300
TGTAATCAAC ATATTCAATT TTGTTTGTG CGATGTAATC AACTTTTTTA CGGCGTTTGA	3360
ATCCGCCACG ACGTTGTTGA GCCATGTTTT TTCTCCTTTA TAAGTTTAGT TGTCCATTAG	3420
AATGGTAAAT CATCATCTGA AATATCCAAT GGGTTTGTG CTCCAAATGG ATTTTCATTA	3480
CGTGAAAAGT CTGGTACTGA ATTTGTAGGT GCTGAATAGT TTGCAGTTGG TGCAGAGTAA	3540
GCTCCACCTG TGTGACCTC ACGCACACTA CGGCTTTCCA ACATTTGGAA ATTCTCAGCC	3600
ACGACCTCTG TCACGTAGAC ACGTTGTCCT TGCTGGTTAT CGTAACTACG AGTCTGGATA	3660
CGACCTGTCA CCCCGATAAG TGAGCCTTTT TTAGCCAGT TAGCAAGATT TTCAGCCTGT	3720
TGGCGCCACA TAACGACATT GATAAAATCA GCCTCACGTT CACCATTTTG ACTCTTAAAT	3780
GTACGGTTTA CTGCAAGAGT AAAAGTCGCA ACTGCTACAT TTGATGGGGT ATAACGCAAC	3840
TCAGCGTCAC GTGTCATACG CCCTACAAGT ACAACATTGT TAATCATAGT TTACCTTCTT	3900

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ACGCGTCAAT TTTGACGATC ATGTGACGAA GAATGTCAGC GTTGATTTTT GAAAGACGGT	3960
CAAACTCTTT AAGAGCTGCA TCGTCATTTG CTTCAACGTT AACGATGTGG TAAAGTCCTT	4020
CACGGAAATC TTGGATTTTCG TATGCAAGAC GACGTTTTTC CCAAGTTTTT GATTCAACAA	4080
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CTTCTTCAAT GTTTGGACGA ATGATATAAA GAATTTTCGTA TTTAGCCATT GATATGTTCC	4200
TCCTTTTGGT CTAATGACCC CAAGACTTTG CAAGGGGTAA GTGAGGTTTCG CTCACAATAA	4260
ACTATTATAC TAGAAAAAAT TTTTTCACGC AAGTAAAAAC ACTAGAATTC GAAAAAACGC	4320
CACATGGCGG TTTTCCTGTT CTTATGGTTT GATACGGTGC AACATACGTG GGAATGGAAT	4380
AGCTTCACGG ATATGTTTTG TTCCTGCTGC GAAGGTTACC ATACGTTCTGA TACCGATACC	4440
AAATCTCCG TGTGGAACG TACCGTATTT ACGAAGGTCA AGGTAGAATT CATATTCTGT	4500
ACGATCCATG CCAAGTTCAT CCATCTTAGC GACAAGGGCA TCGTAATCTT CCTCACGCAT	4560
AGACCCACCG ATAATTTCTC CATAGCCTTC TGGAGCAAGC AAGTCTGCAC AAAGCACGCG	4620
CTCTGGATT TCCAGGAACG GTTTCATGTA GAAGGCCTTG ATGGCTGCTG GATAGTTTAT	4680
GACAAATGTT GGCACACCAA AGTGGTTTGA AATCCAAGTT TCGTGTGGTG ACCCAAAGTC	4740
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GTCAATGGCT TGATCGTAAG TGATACGTTT GAATGGCTCT GCAATGTAGC GTTTCAGAG	4860
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CTCAGCATCC ATCATCCAGA ACTCAGTCAA GTGACGGCGT GTTTTGTGAT TTTTCAGCACG	5040
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CTGACCTGAT TGGCTCAAGT AGGCTGGCGT TCCGAAGTAG TCAGTTTCAA AGAGTTCTGT	5160
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TTGGCTCAAG CGTTTGATAA CATCAAATTT CTCAAGTCCC ACTTCTTCAC CAAATTTTTT	5520
GACAAAGTTT GGTTTAAAAG CCACACCTTG AAAGAAGGCT GTTCCATCAC GCAATTGTAA	5580
GAAAGCGATT TTTCTTTTTC CTGATTTGTT GGCAACCCAA GCGCCAATCG TCACTTCCTG	5640
ACCAACATAG TCTTTTACGT CAATAATCGT TACACGTTTT GTCAATTATTT TTCCTTTTCT	5700

TTTTTATTCT TTATGGCAAA CCACCTCTAT ATTGTTCCCA TCCAGGTCAA TCATAAAAGC	5760
AGCATAGTAA ATCGGATGCT CACTTCGATA ACCAGGAGCC CCATTGTCTC GCCCACCTGC	5820
CTCTAAGCCA GCCTCATAAC AAGCCTGAAC TTCTTCCTTA TTTTCTGCTA AAAAAGCAAA	5880
ATGAACAGGA TCTTGTTGTC CCTGAGTCAG CCAAAAATCA CCACCAGGAT GAGGGCTGTT	5940
CGGGGATAGA AAACCTAATTA GAGAACTAGT CTTAAAAGCC AATTTATAGT CCAAAGGAGC	6000
GAGAAAATC CTATAAAATC CTTATGAAAT TTGTAAATCC TTTACCTTAA TCTCAAAATG	6060
ATCAATCATT CTCCTACCC ATAAATGCTT TCAAGCGTTC GACTGCTTCT TTAAGCGTGT	6120
CTAGGTCTGT CGCATAGCTG AGGCGGACAT TTTCTGGTGC TCCAAATCCA GCTCCTGTTA	6180
CCAAGGCCAC TTCGGCTTCT TCTAAGATAA CAGTTGTAAA GTCTGTCACTA TCCGTGTAGC	6240
CTTTCATCTC CATGGCCTTT TTGACATTTG GGAAGAGATA GAAGGCCCTT TCGGGTTTGA	6300
CCACTTCAA TCCTGGTACC TCTGCAAGGA GGGGATAGAT GGTATTAAGA CGTTCCTCAA	6360
AGGCCTGACG CATGCTTTCT ACAGTATCTT GCTCACCTGA TAGAGCCTCA ACTGCTGCAT	6420
ATTGGGCTAC TGCTGACGGA TTCGAAGTTG TTTGACCTGC AATCTTGGAC ATGGCAGCGA	6480
TAATGTCTGC TTCTCCAACG GCATAACCAA TCCGCCAACC AGTCATGGCA TAAGTTTATG	6540
ACACACCATT GATGACCACT GTTTGCTTGC GAATCGCTTC CGATAGGCTA GAAATCGGTG	6600
TGAACTCATG ACCATTATAA ACCAAGCGGC CATAGATATC GTCTGCTAGG ATGAGAATAT	6660
CATTTTCTAC AGCCGAGTTT CCAATTGCCA AGAGTTCCTC ACGGGTGTA ATCATACCTG	6720
TGGGATTAGA TGGCGAATTC AGCACCAAAA CCTTGGTCTT GTCAGTGC GA GCTGCTTCTA	6780
ACTGCTCTAC GGTCACTTA AAGTGATTGT CTTCTTAGC AGAAACAAAG ACGGGAACGC	6840
CTTCTGCCAT CTTGACCTGA TCTCCATAGC TAACCCAGTA TGGGGTTGGG ATGATGACTT	6900
CATCACCTGG ATTGACCACA GCCATAAAGA AGGTATAGAG AGAATATTTG GCTCCCGCAG	6960
CGACTGTAC TTGATTTGAC GCTACAGAAT AGCCGTAAAA GCGCTCAAAG TAGCTATTGA	7020
CGCCCGCCTT AAGCTCTGGC AGACCTGAGG TTAGTGTATA AAAAGAAGCA CGCCCATCTC	7080
GAATCGATGC AATGGCGGCA TCTTGGATAT TTTTGGGAGT AGTGAAATCT GGCTCACCCA	7140
AGGTTAGAGA CAAAATATCT CTACCCTCAG CCTTCAGTGC TTTGGCACGG GCTCCAGCAG	7200
CCAAAGTCAC ACTTTCTTCC ATTTCTAAAA CACGGTTGGA TAGTTTCATA GGCCCTCCTT	7260
GTGACCAAT GCTCCTGTTT CAAAATCTAC TAGATAAAAA TCAGATCCTG ACTTAACTTC	7320
CCAGATTGGC TTATCTTGAT AACGGCCAAA GGTATCTTG TCAATCTCGC CAGCTCCCTT	7380
TTCTTAGAA ACCGTTTCTG CTTTTCTTG TGAAACACCC TGATTAGCT GATAAACGTA	7440

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AATCTTATGG TCATCTTTAC CAATCAGGAC AGCAAGCGCT TCTTGCTGTT TGTTACGACC	7500
AAGAACGCTG TAATAAGATT CCAAGCCATT GTATAAATCA ACCTGATCAG CCTGCTCTAA	7560
TCCTGCATAC TGCTGAGCTA ATTTTCTCC TTCACMTTTA GCTGTTTGAT AGGGTTTCAT	7620
GCTAAGAGAA ACCATATACA GAAAGGAACC ACTGATAACC ACAAACAAA TCGTCATCCC	7680
TAGACCATAC TGCCACAGTA GATTATTTT TGCTTTGTTT TGTCTTTTTC TCACTCGTCT	7740
ATTTTACCAT CTATTAAGCT TTATTACAAG TGAATATAAG AATACTCTTC GAAAATCTCT	7800
TCAAACCACG TCAGCTTTAT CTGCAGACCT CAAAGCTGTG CTTTGAGCAA CCAATTCTAT	7860
TTCTCCCTTC AAACAAAACC GATTTTGAAA GTGAAACAGT TCTTACTTTT TCAGTCACAA	7920
ATGATTAGAG TTTGCCGGG	7939

(2) INFORMATION FOR SEQ ID NO: 10:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 9897 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 10:

CCGCTCTACC GTCAATAAT TACCATTTTG TTTAATACCG AAATTTTAT CTAAGAAAA	60
TTGAGTTGGT CTGTTGGTAC GATCGTCGTA TACAGTACCA TTCTCAGAA TAGTATAATT	120
GTAATCAGTA TCACCTTGTT TCCTTAATTT AAGGTAATAA TTACCATCAA TTTGTTTATA	180
ACCTGAATCT TTTCTAGTTG CTTCTCTAAA ACTTACTCCA GCAGGCATCA CATCAGCAAA	240
CATGAGTACT TGTTTGTTCT TTTTTCACAC AATAACAGAG TCAATATAGG TTGCACCACC	300
GCTGATTGTG AAGTCACGTC CACCAACTTC ACGAGGCCAT TCTAATGGTA CTGGCGCAAA	360
ATCATCGAAT GCCAATGTTA ATTTTGTTT AGTCCATGTC TTACCATTAT CATCACTATA	420
ACTTGTAGCA ATATTAATTT TATTCAGAA ATCATGAGTT CCACCGTAAC GAGCGTCAAT	480
GCTTGAAAAT ACCCGACCAT TGCTAAAAGT ATACAGAACT GGAATACGGA AATAGTTAGA	540
ACCTGTTGTA TCATTAGCCG TATAAATTAA ATGTCCAGTA ACAGCGTTG TTGTCATCTT	600
TTTAACAGTT TCTTCATCCA ATGCACTATT AAAGAATTTG ATATTTTCTA GTGTTCCGTT	660
AAAACCAAAC GCCGTTTTTC CTGCACGTTT CACTCCCCCA AGCATATAGT AATCAATACC	720
TTTAATATCC TTGATGTTTA GGAAATTATC CACTTCTTTT TCTACTACTT TTGTACCATT	780
TGCGTATAAA GAATATGTTT TTTTGACTGA ATCTGCTACT ACTGCAACAG TGTTAGTCAC	840
AGCCTCTTGT TTGTACTTAC CCCAACTGA AGCAGGTCTG GATACTAGGT TATTTTATT	900

215

GGAAGAAGTA TCACGCGCTT CCATCCCCAA CTCACCATTTG TCTCTAAGGA ACACATCTAC	960
ATAACTATTT TGTGACCGG GTTTGGAATT AGATATTCCA AACAGAGCTT GTAAGCCTTT	1020
CTCACTTGAC TGATGTACT TAATCACTAC AGTAAAGTCA CCGCTAGTAA ATTTATCCTT	1080
TAACTCTTTA GTAACATTTT CTCCGCCCCC TGTAAAGTA ACATTATTTT TTTCTAAGAC	1140
AGGAGTTTCT TCCGCTGTAG AAGATGGATC CTTAACAGTA GTTTCACCTG TTCGAGGTTG	1200
TACAGTAACT TCCGAAGAGT TATCCGATGT AGGTGTACT TCCGAAATCG GAGTCGTTGG	1260
TGCAACAGGT TGCACCAACT TTGGTGTGA TACTTCAGAA GTTTCAGTCT CCTGAGCTGC	1320
AACTGAGTTA GCAACAAATG CTGATAATAC CACTACAGTA CCTAAGGTTA CATATTGTTT	1380
AATATTTTTT TTCATTTTAT TTTTCTCGT TTAACACTTT GATAACAAGT TTTTAAACAG	1440
TTTCATCATT GCAATGAATC TTTGGTTGGT GAAGATCTTC TTCAAAAGTC ACCAACATAT	1500
TCCCTGGAAG CAATTCACAA ATTTGATAGT CTTTGCTATC GTAAAAGCA ATATCCTTCT	1560
CTTCGCTAAA AGGTACACGT GACTGGGCAC GAACTGGGGA AGTTACTGCC ATTTTTCAG	1620
TATTTTCAAC AACAATATGA ATATCTAAAT ATTTCTTATG AGTTTCAAAA ATATCTCCTG	1680
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TTTTTCCATC AACTAAATCT GTCAAATTG TATTTTCTAA AAAATCACAG ACTTTTGAAA	1800
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TTTCTCTTTT CTATTAGTGA CGAACTTCCC AACTTGAATC CGCTTTAATT TCTGTAATAT	1920
CATGAATCGT TGTATATTTA GGTGCAGATA CTTTATTTCC AGTAAGAACA GATACAATAT	1980
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GAGCCATGAC AATGGAAACA CCAATTGAGA ATAAACCTAC TGCTAGAGAT ACGAATTGTG	2280
CAATTTTCGT ACGACGATTG TCTGACATAT TTTTAGAAAT GACATCTTGA ATATCCAATG	2340
TCCATGAAGT TGCAACAGAG TTCAAACCTG TTGAAATAGT TGATTGAGAT GCTGCATPAA	2400
TCGCTGCCAA GATCAAACCT GTGATACCTA CTGGTAACTG GTATGCAATA AAGTACATAA	2460
AGATTTGGTC TTGAGGGATA TTGCTAGCTG CACTATCTGC ATTTTGTACT TGATAGAATA	2520
CGTACAAGCC TGTACCAATC AAGTAAAGA CTGTTGCAGT TGCAAGTGAC AAAACACCGT	2580
TTGTGAACAA CATCTTATTA AGTTCTTAA TATTTTGTGT TGATGATAAA CGTTGAACCA	2640

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AGATGGAGTT TGAAAGCAAG TTAGGATCGA AAAGTTTTTC ATTTGCAGCA AGGAATTTCC	2760
CGTTTGCTAA TGTTCCTGCT ACTGCACCAA AGCCACCTTT AATATTAGCA ATCAGTACAA	2820
ATAAAGCTAA AACGACACCA CTAATCAGAA TCACACCTTG AATAAAGTCT GTCCATAATA	2880
CGGATTTTAG ACCACCAGTA TAAGAATAAA CAATTGCAAC TACACCCATC AAAATAATCA	2940
AAATATTGAT GTCAATTCTT GTCAATACTG ATAAACCAGC TGATGGGAGG TACATAATGA	3000
TAGACATACG TCCCAATTGA TAAATAATAA ACAAGAGTGC TGAAATAATA CGAAGTGCTT	3060
TAGAATTAAG ACGTTTATCC AAGTAATCAT ATGCCGTATC GATGTCTATC CGTGCAAAGA	3120
TAGGTAAGAT AAAACGAATT GTCAGTGGAA TAGCTACTAC CATCCCTAAT TGAGCAAACC	3180
ATAAAATCCA GCTACCTGCA TAAGAGCTAC CAGCGAGTCC CAAGAAGGAA ATCGGACTGA	3240
GCATTGTGGC AAAAATGGAT ACCGAAGTAA CATACCAAGG AACCGAACCA TCTCCTTTAA	3300
AGAACTCTTT TCCTTTCATC TCTTTTTCAG AGAAATAGAT ACCTGCAACC AACACCGCAA	3360
GTAAATAAAC AATCAAGATA ATTAAGTCAA TTATTGTAAA TCCTGTTGTG CCCATAACAT	3420
ATCTCCATAT TGATTTTATT TATTATAAAA ATTCTTTTCG TGCTTGTGTA ATAAGTTCTG	3480
CTGCTGTGTT TGCAACTTCC AAGTCACCTT CTGCCAATGC TTCTAAAGGT TGACGAACAG	3540
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TATCTAAATC TCGTTCTTGA ATCAAACCTT CCAATTTCAA GAACAAATCT GGCATAACGC	3720
CATAAGTACC ACCAATACCA GCTTCTGCTC CCATCAAGCG ACCACCAAGA TATTGTTTCT	3780
CTGGACCATT GAATACAATG TAATCTTCTC CACCTGCAGC TACAAACATT TGAATATCTT	3840
GTACAGGCAT AGAAGAATTT TTAACCTCAA TCACACGAGG ATTTTGACGC ATTGTTGCAT	3900
ACAAACTACC AGTCAACGCA ACCCCTGCCA ATTTGTGGAAT ATTATAGATA ATAAATCTG	3960
TATTTGACGC AGCTTCACTC ATTGCAATTCC AATATGCTGC GATTGAATAC TCTGGCAATT	4020
TGAAATAAAT AGGTGGGATA GCTGCAATAG CATCGACTCC AACACTTTCT GAATGTTTTG	4080
CCAATTCGAT ACTATCTTTC GTGTTATTAC ATGCAATATG GTTGATAACT GTTAATTTAC	4140
CTTTAGCAAC TTCCATAACA GCTTCAATAA TTTGTTTACG ATCTTCTACA CTTTGGTAAA	4200
TACATTCAAC TGAAGAACCA TTTACATAGA TACCTTTTAC ACCTTTGTCA ATGAAATATT	4260
GTACCAGAGA TTTTACACGA TCTTGGCTAA TTTCACCATT TTCATCATAG CAAGCATAAA	4320
ATGCAGGGAT AACGCCTTTG TATTTAGTTA AATCTTTCAT CAGATTTCTC CTTTATATTG	4380
TTTTTTATTT GATGACATTA ATAAATCGCT GAGCAATTTT TTTTGGACGT GTAATCGCTC	4440



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GAATTTTTC TCGGCAATTA CCGGAATATT AAAATCAGCC AATTTTTC TTAGTTCAAA	4560
ATCAGGCTCA TCTGATTGTA CACTTGTA TGTGTAACCT GATAATGTTG TACCAACAAA	4620
ATCAACGCCT GATTTAAATG CATAGAGACC TTCATCTAAA TTACTTACAT CCGCCATCAG	4680
CAATTGATTC GGATATTTT CTTTATTTT TTTGATAAAT TCACTGACAA CTAAGCCATC	4740
ATATCTTGGT CTAAAGTTG CATCAAATGC AATGACTGTT GTTCCGCATT CTACAAGTTC	4800
ATCTACTTCT TTCATCGTAG CAGTAATATA TGGTCTTGA GGTGGATAAT CCCTTTTGAT	4860
AATTCCAATT ATTTGTAAT CTACTACTT CTGAATTGCT TTAATATCAC GCACAGAATT	4920
TGCGCGAATG CCCACTGCTC CTGCCTCTAA AGCTGCTTTA GCCATAAAAG GCATCAAGCT	4980
AAATCTTCA TTATAAAGG CTTCACCAGG TAAAGCTTGA CAAGAAACAA TGACTCCACC	5040
TTGAACCTGG CTATAAATT TTTCTTAGT CCAAAATTGG CTCATTTTAT TATTCCTCCT	5100
TATGGATAAT AGTTTGATTG TAATAATATT GTCTCTCTGG ACTTCCAGA TAATTAGAGA	5160
ATAAGCAGTC TGAATTAAA AGTATTGGA ACTGAGGTGA TATGCGATTG CCATACGAGA	5220
GATGATCGGT CGAAGCTAAT AACAATAGT CATCAAAGAA ACAATCTTCT TCGTCAAATT	5280
TTCTTGTAAGT CATTAATACT GTTTAGCGC CTTTATCTGC AGCTTTTGT AGACCTTCTA	5340
GTACAATATC AGTTTGACCT GAAATGGATG CTCCAATGAC AAGGCAATTT TCATTAAGTA	5400
GTAAGTACT CCACAAAATC ATATCTCTGT CTGATAATAC TTCACCAATC ACTCCGAGAC	5460
GCATAAATCT CATCTTCATT TCTTGTAAG CAAGAACAGA ACTTCTTTA CCGTAGAGAT	5520
ATACACGCTC AGCAGTTTCT ATCATCTCAG CAATACGCTC AAGTTGAACT TCATCAAGAA	5580
CCGTGTAAGT TTTTCTCAAC ATTTCTCAT AGTCGGATAA AACTTTTCT GTTGCCCTCTG	5640
TATATAATGC CAACTTTTCT TTCTCATGAA TCATCTCTTG GTATTTGAAA ATGAATTGTC	5700
TAAACCTTT AAAACCACAT TTTTCGCAA ATCGAGTCAA TGTGCTTTG GATACATTAA	5760
GGTATTCGCA CAATGCTTTA GATGAATAAT CATTGAGAGG TTGCTGTTT AAGAAGAATT	5820
TAGCAATGTC TTTTCAGCA TATGCCATAT TTGGTAAGTT AGCTTCTATC ATTGGAATTA	5880
GTTCTTTTG CAGTAACATA TGAGCTCCTT AGTTGAAGTA AACGTTTACA TTCTTTATTT	5940
TAACTTTT TTTTTTTT AATATTTT ATAAATTAGA AACTAGTTT CAATTTCTTT	6000
CGTTTCATAA CAGAACAACA AACATAAAAA TATAATAGTT TTTATCTTT TTATCGTAAT	6060
TATATGTATT GTAAGAACGT TTATCACTAA TAATATGTT ATATTAAAT ATTTTAGTAA	6120
TATTTTATT TGGTTTATT ATTTCTTTT GGAATTTCTA TATAATATT TATTTCTAAA	6180

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AAAATTGAAA AAATATTCT AGTTTCTTTA TTTATATAG GTAATATATT TTATTTCTAA	6240
ATTAAAAGAG AATCCCATAA AACTACAGA TTTATGAGAT AAATCAGGTC ACCTATTTTA	6300
AAAAAGCAGC AACTATAAA CTAAAAAGTT CCACACCAA TGTAACCCCA TACTTCCCCA	6360
TAAGTCAGAT TTATAGCGCA CCATACCTAA AAACATTCCA AGTGAAACGT ACAGACACCA	6420
AGCTAGAATG GTTCTGGAT GATGTACTAA GGCAAATAAA AACTTGTCA AAGCAACTCG	6480
AATATCTAAT TTTCTAACCA AGTTCATAA AATTTCACGA TACAGAAATT CTCAACCAT	6540
ACTCGCATTG ATTAAGAACA ATAAAAATGA AAACCAAGGA ACTTGATGTT GAAGGCCAAT	6600
TAAATTGTGTT TGATTCGTGC TTCCTTGAGC ATGAATCAGG CTAAACATA GACTTATAAT	6660
CAGTAGACTA GCTAGTCCAA TACCAAGGCA TTTCATCCTA GTTTTCATAT TGACCTTGAC	6720
CACTTGTTTT CGTTGACCAT ACATCCATAA AAAAGAAAA AGAGACGCAC CATAGAGAAC	6780
CTGTAGTATA GTTAACCTAC CGATACAAAG AAATTTCAAT AAGTATAGAG ATACCAATAG	6840
GACATTTACT TGTGGAATA TATAAACTGG AATTATTCTT TTCATAGTTA CCTCCGAAAT	6900
AAATCTTCAT AATCTAAATC TAATATCTGC ACAATCCTTT CTACCCATGG ACTTTGAGGC	6960
ATTCGTTGTT CCATCTTGTA GTGGCGAATC TTTTGATATA AACGATTCAA TTCACTTGGA	7020
TAGTGAACT CTCCCGCAA CATTTTCTG GTTAACCTAA TCCAGCTGAT ATTTCTTTCA	7080
GCCAAATAA TGGACAAGTT CTCCCAAAAT CGTTCAGCCA TATTCTTCT CCTTTAGTTA	7140
GATAATAAT GTGTTGyGC CATGTAAATC AATTGTTTCG TATCTCTTGG CAATAGAGCT	7200
CTAGCCTCTT CCAAAATCAG ACTTGGATAA ACCCGCTTAT TTGAAACCAC AAAAGGAAGT	7260
CCGATGGTTA GTTCAGGATT TTTTAAAT ATCTCAACGA AATCCGTTAA TCTTAGATTG	7320
TCACGGTTCT TAAATCGTAA TAAATTGGGA GATAAAACT CAAAACAATC TGAAGAATAG	7380
CTCATCATCT CAATTAATTT GTCCTTGTG ATTTTCAGAA CTGAATGACA AGATACCTCA	7440
ATGCCATAGT TTTGGAAGAA GTCTAAAAGA AGTTGATTTT TTTGGCTATT TTTACTTAGA	7500
TAGAGATCAA TCATGGGAGA CCTCCAACAA ATTTGCTTCC ATTTGATATT CTGAGACGAT	7560
TAAGGAATCT AACAACTTTG AGAAGTTAAT CGATTCTTG TCTTCATCAT AAGCTTTTAC	7620
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AAATATTGT TCATCCAGCT GTTGATTTT TGCATCATGT AATTCTGTTT CTAATTCATC	7920
ACAATCTAGT ATTGATCTT TATTTAATGC TTTTATCTTT TTCCTCTATT TCTTTAATT	7980

TCTTTGCGAT	TGCGGCAATC	ACAGGAACGG	TTACACTATT	ACCAACTTGT	TTATAGAGCT	8040
GACTATTAAAT	AGAGACTTTT	CTAGCAGCTT	CAAAAGCCTA	ATCAGGAAAG	CCATGCAATC	8100
GAAACACTC	TTTAGGAGTG	ATTTCGTCGT	TTCTCAAACG	GTAAAATTGT	CCATCTATTA	8160
AAACACCAGC	TACTTGGTAA	ACTTGTATTAT	CTTCTCCTTC	ATAGCTAGCC	ACTACTACTC	8220
CCATTTGACC	ACTAGTTGTT	AACGTATTAG	CTATACCTTT	TCCAACCTTA	CCACGACGAT	8280
ACTGAGAACT	TGGTCTTTCT	AAATTGATTG	AATCCCCAAT	CTCTGCTTGA	GCAATATCCTT	8340
TTTTCGTTGC	TTCCCGTACT	TTTAGAAATT	GGATTGGTTC	TGGAATTAGT	ATTTTGGGGA	8400
TTTTATCTCC	TCCTTGCATC	GTAGTCAGTG	TTGGAGATAA	GCCCTCACTT	CCATAGACAC	8460
GACCTGTCTC	CTTAAAGCTA	GTCGGTAAAT	CTCCAACAAC	GACAATGCCA	TAACGATCCT	8520
GAGTATTTAA	AGTAAACATC	GGCTCTTGAT	TTTCCTTAAA	GCGTCTCCCA	TTTTGTCTCT	8580
TGTCTAATCT	ATCTGGTGTC	ATACAAGGAA	TCGCAACTTT	AAATCCTTCT	CCTTTACCAC	8640
GAAC TAAGGT	TGGCGCAAGA	CCTTCTGAAT	AATAGACTTT	ACCGCTCATT	CCACTTCTTG	8700
ATGGATTCAA	ATTTCTAGT	GCTTTCAAAG	TCTCAGAGTT	AGTTGCTTGA	CCTTCTCGTC	8760
TGAAAGGAAA	TAAGAGTCTG	GTACCTTTCT	TTCTAGAATG	TCCGATAATA	AACACCTCT	8820
CTCTGTTTTT	GGGAACGCCA	AAATCCTTAC	TGTTAAGCAC	CTGCCACTCA	ACATCAAACC	8880
CCAACCTATC	AAGTGTGGTA	AGTATTGTGG	TGAACGTCCG	TCCCTTATCG	TGATTGAGTA	8940
GGCCTTTAAT	ATTTTCAAGA	AAAAGAAAAC	GTGGTTGGAT	TTGTTTGGCC	GCCCAGCAA	9000
TTTCAAAGAA	CAAAGTTCTT	CTAGTATCTT	CAAATCCCAA	TCGTCTTCCT	GCGATTGAAA	9060
ATGCTTGACA	AGGGAATCCC	CCACAGATGA	CATCGACTTT	CCCTCTAAGT	TTTTTAAATT	9120
CGTCATCTGA	AACATCTCGT	ATGTCATGAA	ATTCTATTTC	TCCTTCCGTT	TGAAAAATGG	9180
ACTTATAAGA	TTTCTAGCA	AATTTATCAA	TCTCACAAAA	TCCCAAGCAC	TCATGCCCTT	9240
GAGCTTCCAT	TCCCATCCTA	AAGCCTCCTA	TCCCAGCAAA	TAAATCTAAA	ACCCAAATCA	9300
TTCATACCTC	TCTCAACTAG	ATGTAACCTA	CAAAACCCCT	GACCTCATGA	GCCACTTTCT	9360
TCCTCCTCAT	GAGGTCAAGT	TTACTTTCTG	CTGTTCCAGT	ATCGTTTTTC	CTCGCTAGAT	9420
TTCTCAAAA	GGGCAGACTC	CTCCCTGGT	TCGTCACACG	ATTTTTTCAT	CTCGACTGTT	9480
CTTTAATGCA	TCATTAACGA	CGCTTTTCTT	CTAGGTGGTT	CATAAGGAAC	AGGAAGATTC	9540
AGGTTGACTT	TTCTAATCCT	AGAATAAAGT	GCTGAAAACA	ATTCGGAATA	GGCATAGAGA	9600
CTAGACAATT	TGAGGAGCTG	CTTGCGTCCT	GTTGGAACAC	ATTTTCCTAC	CACGTGAAGA	9660
AAAAGATGGC	GGAAGCGTTT	GATTGTTAAA	GTTTGGAAGT	CACCTCCAGC	TAGATGTTTG	9720

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AGAAAAAGAT AGAGATTGTA GCGGATACAG CTCATCATCA TACGAACTCG TTTTGTGATTA 9780  
AGGTTGAACT ATCCGTTTTA TCGCCAAAAA ATCCCTCCTT CATCTCCTTG ATGAAATTCT 9840  
CGGCTTGACC ACGTCCACGA TAAAGCTGAA ACTGGTCTTG GCTTGTTCGG GTACCGA 9897

(2) INFORMATION FOR SEQ ID NO: 11:

- (i) SEQUENCE CHARACTERISTICS:  
(A) LENGTH: 8148 base pairs  
(B) TYPE: nucleic acid  
(C) STRANDEDNESS: double  
(D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 11:

CCGTGGAACA AGCCAAGACC AGTTTCAGCT TTATCGTGGA CGTGGTCAAG CCGAGAATTT 60  
CATCAAGGAG ATGAAGGAGG GATTTTTTGG CGATAAACG GATAGTTCAA CCTTAATCAA 120  
AAACGAAGTT CGTATGATGA TGAGCTGTAT CGCCTACAAT CTCTATCTTT TTCTCAAACA 180  
TCTAGCTGGA GGTGACTTCC AAACTTTAAC AATCAAACGC TTCCGCCATC TTTTCTTCA 240  
CGTGGTAGGA AAATGTGTTC GAACAGGACG CAAGCAGCTC CTCAAATTGT CTAGTCTCTA 300  
TGCCTATTCC GAATGTGTTT CAGCACTTTA TTCTAGGATT AGAAAAGTCA ACCTGAATCT 360  
TCCTGTTCCT TATGAACCAC CTAGAAGAAA AGCGTCGTTA ATGATGCATT AAAGAACAGT 420  
CGAGATGAAA AAATCGTGTG ACGAACCAAG GGAGGAGTCT GCCCTTTTGA GGAAATCTAG 480  
CGAGGAAAAA CGATACTGGA ACAGCAGAAA GTAAAACTGA CCTCATGAGG AGGAAGAAAG 540  
TGGCTCATGA GGTCAAGGGT TTTGTAAGTT ACATCTAGTT GAGAGAGGTA TGAATGATTT 600  
GGGTAAATAC AATGAGCTTG AAAGAAGTAG CAAACTCACC AAGCGCCAAT TCTTTGAGAA 660  
TCAGATGCTG GATTATACCA TCATTGCGCA TGAGAGTTTT GAAATCATCC GTCATTCTGT 720  
CTACCAGACA GATGATCGTG AAGTGGAAAA TGCTCTGGCT TTTGAAGTGA AAAATGATGA 780  
AACAGACAAG CTGATTCTGT TATTAAGCGA GGATATTGGT GTAGGTGAAA AATTGTGCCT 840  
CGTTGACGGA ACAAAAATGC GTGGAAAATG TTTAGTATAT GATAAAATAA ATGAGAGAAT 900  
GATTCGCTTG CAGTGCTAGA AATAGGCATT TTGAATAGTG AATATGTTAT AATAAGTATT 960  
AGTAGGAGGT GTTTTAGATT GGAGAAGAAA CTGACCATAA AAGACATTGC GGAAATGGCT 1020  
CAGACCTCGA AAACAACCGT GTCATTTTAC CTAAACGGGA AATATGAAAA AATGTCCCAA 1080  
GAGACACGTG AAAAGATTGA AAAAGTTATT CATGAAACAA ATTACAAACC GAGCATTGTT 1140  
GCGCGTAGCT TAAACTCCAA ACGAACAAAA TTAATCGGTG TTTTGATTGG TGATATTACC 1200  
AACAGTTTCT CAAACCAAAT TGTTAAGGGA ATTGAGGATA TCGCCAGCCA GAATGGCTAC 1260

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CAGGTAATGA TAGGAAATAG TAATTACAGC CAAGAGAGTG AGGACCGGTA TATTGAAAGC	1320
ATGCTTCTCT TGGGAGTAGA CGGCTTTATT ATTCAGCCGA CCTCTAATTT CCGAAAATAT	1380
TCTCGTATCA TCGATGAGAA AAAGAAGAAA ATGGTCTTTT TTGATAGTCA GCTCTATGAA	1440
CACCGGACTA GCTGGGTAA AACCAATAAC TATGATGCCG TTTATGACAT GACCCAGTCC	1500
TGTATCGAAA AAGGTTATGA ACATTTTCTC TTGATTACAG CGGATACGAG TCGTTTGAGT	1560
ACTCGGATTG AGCGGGCAAG TGCTTTTGTG GATGCTTTAA CAGATGCTAA TATGCGTCAC	1620
GCCAGTCTAA CCATTGAAGA TAAGCATACG AATTTGGAAC AAATTAAGGA ATTTTACAA	1680
AAAGAAATCG ATCCCCATGA AAAAATCTG GTATTTATCC CTAAGTGTG GGCCTACCT	1740
CTAGTCTTTA CCGTTATCAA AGAGTTGAAT TATAACTTGC CACAAGTTGG GTTGATTGGT	1800
TTTGACAATA CGGAGTGGAC TTGCTTTTCT TCTCCAAGTG TTTCGACGCT GGTTCAGCCC	1860
TCCTTTGAGG AAGGACAACA GGCTACAAAG ATTTTGATTG ACCAGATTGA AGGTCGCAAT	1920
CAAGAAGAAA GGCAACAAGT CTGGATTGT AGTGTGAATT GGAAAGAGTC GACTTTCTAA	1980
AATGAAGGAA AATGACTTGC AATCTCTGTT AAGAAATAAA ATAATCCAC CTAGAACAAG	2040
CTAGGTGGGA TTATTGCTT ATGAAATGAG AAATTATGGG AGCAAGCTCC TAAATCAACT	2100
GTTTTGATC TACTTCTTTA ACTACTGAT AAAAGTTATA GAAGTAGGCC AAAGTTGAAA	2160
TGATGGTTAC GACTAGGAAT ATTGAAAATT TCCATTGGAC AGGGTTGGTT AAAAGTTGTG	2220
GAAAGGATAT GAGGAGAAAG AAGAGGGCTG CGTTGAGGAC AGGTATCCGT TTTGATTGTA	2280
TTTTCTCAAG TCCTTTATTG AGCGCAGGAA GAAAGAGGAG TAGGAGTAGT AAAACTGTAT	2340
GAGAAATAGC TCCTGAAGTA AGGGCGAAGA AAAGGAAAAT ACTGATAAAA ACATGAATGA	2400
TCAGTAGTCT AGCTAGTGAT TTCATAAGGC ACCTCCTAAT CCTGGTCTTT TTAGCTCTT	2460
GCAATACGAA GTGAGTCGAC AATATGTATC ATCACTCCGA AAAAGAAAGC TCCCAGTATA	2520
GTTTTAAAAA TATGTTTTGT ATTTAGAAGA GAACTGATAA AATTTGGATT TTCATTGTT	2580
AGGGTATCAA TGAGTGGAAT TATAAAAAAT ATCACTGTTT CATAAATCGA ACCTGCTTTC	2640
AGACCAGGAT AACGTAACGT TTTCTTTTCT TTTTTCATGA GTTTCCTCCT AATCCTCATC	2700
TTGATTTTTC TTAGTTTTTG CAATGCGACG GGAGATGAGG AACTGTATGC TCGCTCCGAA	2760
GAAAAATAGAA CCGAGAATAC TTGATACACC ATTTCTTATA GTGAGAAGAG AATGAAAAA	2820
GTCTTGACCT TCATCTATGA GTATCCTGAG AAGAGGAGTT ATAAAAACA TCCATAGACC	2880
AAAGAACAAA CCTGCTTCA GACCTGGGTA GTGTAGTTGC TTGCTTTCTT TCTCATTCAG	2940
CATATCTGGT TCAATGACTG TGATGCCTGT TTTTTCATT TGGTAGGTGA CATAGCCAGA	3000

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AGCGATGAGG GCAATCACTA AAATCAGAGG AGGATAGATT AGAGCCACTT CTTGAGGGTA	3060
TTTATAGGCC AGAAGGAGTG GAATAAGATT TCCGAAAATC ATCAGATAAA AGAGGATGAT	3120
AAAGACTTGG TTCCAATAC TATCGGCCTC ACGCCGTTTG TATTCGTCAA GGGGACCAGA	3180
AATACCGTAT GTGCGTTGA TCAGTTTTC AGTGAAGCTT TCTTTTTC TGAGTTTGCT	3240
CCTTTTTTAA AAATCTTCCT CCCAAAAGAG ACTGTTGAGG TCAGTTTGA GGCTGCGGGC	3300
GAGATTGAGA CAGAGTTCCA AGGTTGGATT GTACTTGTCG TTTTCAATCA TATTGATAGT	3360
CTGTCTCGAG ACACCGATAT CCTTGGCGAG TTCGAGCTGG GAAATACCCA ATTCCTTGCG	3420
AAATCTTTC ACACGATTCA TCTGTTCTCC TTTCTGATT ATGTCGTATA TATTGACTA	3480
TATTATAGTC TTTTAAACAT AAAGTGTCAG GTATTTTGA CATATTTTT GAAGAAATAG	3540
TAGTCTCCTT GTCCTATTTG TCTGACAAGT GCAAGCTGGT CGGATTGTG GTAAAATAGA	3600
TAAGATATGA CAAAAGAATT TCATCATGTA ACGGTCTTAC TCCACGAAAC GATTGATATG	3660
CTTGACGTAA AGCCTGATGG TATCTACGTT GATGCGACTT TGGGCGGAGC AGGACATAGC	3720
GAGTATTAT TAAGTAAATT AAGTGAAAA GGCATCTCT ATGCCTTTGA CCAGGATCAG	3780
AATGCCATTG ACAATGCGCA AAAACGCTTG GCACCTTACA TTGAGAAGGG AATGGTGACC	3840
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ATTGATGAA TTTGTTATGA CTTGGGAGTG TCTAGTCCTC AATTAGACCA GCGTGAGCGT	3960
GGTTTTCTT ATAAAAAGGA TCGCCACTG GACATGCGGA TGAATCAGGA TGCTAGCCTG	4020
ACAGCCTATG AAGTGGTGAA CAATTATGAC TATCATGACT TGGTTCGTAT TTTCTTCAAG	4080
TATGGAGAGG ACAAATTCTC TAAACAGATT GCGCGTAAGA TTGAGCAAGC GCGTGAAGTG	4140
AAGCCGATTG AGACAAAGAC TGAGTTAGCA GAGATTATCA AGTTGGTCAA ACCTGCCAAG	4200
GAATCAAGA AGAAGGGGCA TCCTGCTAAG CAGATTTTCC AGGCTATTCTG AATTGAAGTC	4260
AATGATGAAC TGGGAGCGGC AGATGAGTCC ATCCAGCAGG CTATGGATAT GTTGGCTCTG	4320
GATGGTAGAA TTTCACTGAT TACCTTTCAT TCCTTAGAAG ACCGCTTGAC CAAGCAATTG	4380
TTCAAGGAAG CTTCAACAGT TGAAGTTCCA AAAGGCTTGC CTTTCATCCC AGATGATCTC	4440
AAGCCCAAGA TGGAATTGGT GTCCCGTAAG CCAATCTTGC CAAGTGCGGA AGAGTTAGAA	4500
GCCAATAACC GCTCGCACTC AGCCAAGTTG CGCGTGGTCA GAAAAATTCA CAAGTAAGAG	4560
GGAAAAAGAT GGCAGAAAA ATGGAAAAA CAGGTCAAAT ACTACAGATG CAACTTAAAC	4620
GGTTTTCGCG TGTGAAAAA GCTTTTTACT TTTCCATTGC TGTAACCACT CTTATTGTAG	4680
CCATTAGTAT TATTTTTATG CAGACCAAGC TCTTGCAAGT GCAGAATGAT TTGACAAAAA	4740
TCAATGCGCA GATAGAGGAA AAGAAGACCG AATTGGACGA TGCCAAGCAA GAGGTCAATG	4800

AACTATTACG TGCAGAACGT TTGAAAGAAA TTGCCAATTC ACACGATTTC CAATTAAACA	4860
ATGAAAATAT TAGAATAGCG GAGTAAGATA TGAAGTGGAC AAAAAGAGTA ATCCGTTATG	4920
CGACCAAAAA TCGGAAATCG CCGGCTGAAA ACAGACGCAG AGTTGGAAAA AGTCTGAGTT	4980
TATTATCTGT CTTTGTITTTT GCCATTTTTT TAGTCAATTT TGCGGTCATT ATTGGGACAG	5040
GCACTCGCTT TGGAACAGAT TTAGCGAAGG AAGCTAAGAA GGTTCATCAA ACCACCCGTA	5100
CAGTTCCTGC CAAACGTGGG ACTATTTATG ACCGAAATGG AGTCCCGATT GCTGAGGATG	5160
CAACCTCCTA TAATGTCTAT GCGGTCATTG ATGAGAACTA TAAGTCAGCA ACGGGTAAGA	5220
TTCTTTACGT AGAAAAACA CAATTAAACA AGGTTGCAGA GGTCTTTCAT AAGTATCTGG	5280
ACATGGAAGA ATCCTATGTA AGAGAGCAAC TCTCGCAACC TAATCTCAAG CAAGTTTCCT	5340
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AAGCTGCAGA GGTCAAGGGG ATTGATTTTA CAACCACTCC CAATCGTAGT TACCCAAACG	5460
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AGAGCTTGCT GGGAACTCT GGAATGGAGA GTTCCTTGAA CAGTATTCCT GCAGGGACAG	5580
ACGGCATTAT TACCTATGAA AAGGATCGTC TGGGTAATAT TGTACCCGGA ACAGAACAAG	5640
TTTCCCAACG AACGATGGAC GGTAAAGGATG TTTATACAAC CATTTCACGC CCCCTCCAGT	5700
CCTTTATGGA AATCCAGATG GATGCTTTTC AAGAGAAGGT AAAAGGAAAG TACATGACAG	5760
CGACTTTGGT CAGTGCTAAA ACAGGGGAAA TTCTGGCAAC AACGCAACGA CCGACCTTTG	5820
ATGCAGATAC AAAAGAAGGC ATTACAGAGG ACTTTGTTTG GCGTGATATC CTTTACCAAA	5880
GTAACATGA GCCAGGTTCC ACTATGAAAG TGATGATGTT GGCTGCTGCT ATTGATAATA	5940
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GTTTTGCACA CTCAGTAAC GTTGGGATGA CCTCCTTGA GCAAAAGATG GGAGATGCTA	6120
CCTGGCTTGA TTATCTTAAT CGTTTAAAT TTGGAGTTCC GACCCGTTTC GGTTCGACGG	6180
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GACAAGGGAT TTCAGTGACC CAGACGCAA TGATTCGTGC CTTTACAGCT ATTGCTAATG	6300
ACGGTGTGAT GCTGGAGCCT AAATTATTA GTGCCATTTA TGATCCAAAT GATCAAATG	6360
CTCGGAAATC TCAAAAAGAA ATTGTGGGAA ATCCTGTTTC TAAAGATGCA GCTAGTCTAA	6420
CTCGGACTAA CATGTTTTG GTAGGGACGG ATCCGTTTA TGGAACCATG TATAACCACA	6480
GCACAGGCAA GCCAACTGTA ACTGTTCTG GGCAAAATGT AGCCCTCAAG TCTGGTACGG	6540

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CTCAGATTGC	TGACGAGAAA	AATGGTGGTT	ATCTAGTCGG	GTTAACCGAC	TATATTTTCT	6600
CGGCTGTATC	GATGAGTCCG	GCTGAAAATC	CTGATTTTAT	CTTGTATGTG	ACGGTCCAAC	6660
AACCTGAACA	TTATTCAGGT	ATTCAAGTTGG	GAGAATTTGC	CAATCCTATC	TTGGAGCGGG	6720
CTTCAGCTAT	GAAAGACTCT	CTCAATCTTC	AAACAACAGC	TAAGGCTTTA	GAGCAAGTAA	6780
GTCAACAAAG	TCCTTATCCT	ATGCCTAGTG	TCAAGGATAT	TTCACCTGGT	GATTTAGCAG	6840
AAGAATTGCG	TCGCAATCTT	GTACAACCCA	TCGTTGTGGG	AACAGGAACG	AAGATTAAAA	6900
ACAGTTCCTG	TGAAGAAGGG	AAGAATCTTG	CCCCGAACCA	GCAAGTCCTT	ATCTTATCTG	6960
ATAAAGCAGA	GGAGGTTCCA	GATATGTATG	GTTGGACAAA	GGAGACTGCT	GAGACCTTGG	7020
CTAAGTGGCT	CAATATAGAA	CTTGAATTTT	AAGGTTCCGG	CTCTACTGTG	CAGAAGCAAG	7080
ATGTTCTGTC	TAACACAGCT	ATCAAGGACA	TTAAAAAAT	TACATTAAC	TTAGGAGACT	7140
AATATGTTTA	TTTCCATCAG	TGCTGGAATT	GTGACATTTT	TACTAACTTT	AGTAGAAATT	7200
CCGGCCTTTA	TCCAATTTTA	TAGAAAGGCG	CAAATTACAG	GCCAGCAGAT	GCATGAGGAT	7260
GTCAAAACAGC	ATCAGGCAAA	AGCTGGGACT	CCTACAATGG	GAGGTTTGGT	TTTCTTGATT	7320
ACTTCTGTTT	TGGTTGCTTT	CTTTTTCGCC	CTATTTAGTA	GCCAATTCAG	CAATAATGTG	7380
GGAATGATTT	TGTTTCATCT	GGTCTTGTAT	GGCTTGGTCG	GATTTTTAGA	TGACTTTCTC	7440
AAGGTCTTTT	GTAATAACAA	TGAGGGGCTT	AATCCTAAGC	AAAAATTAGC	TCTTCAGCTT	7500
CTAGGTGGAG	TTATCTTCTA	TCTTTTCTAT	GAGCGCGGTG	GCGATATCCT	GTCTGTCTTT	7560
GGTTATCCAG	TTCAATTGGG	ATTTTCTTAT	ATTTTCTTCG	CTCTTTTCTG	GCTAGTCGGT	7620
TTTTCAACCG	CAGTAAACTT	GACAGACGGT	GTTGACGGTT	TAGCTAGTAT	TTCCGTTGTG	7680
ATTAGTTTGT	CTGCCATATG	AGTTATTGCC	TATGTGCAAG	GTCAGATGGA	TATTCCTCTA	7740
GTGATTCTTG	CCATGATTGG	TGGTTTGCTC	GGTTTCTTCA	TCTTTAACCA	TAAGCCTGCC	7800
AAGGTCTTTA	TGGGTGATGT	GGGAAGTTTG	GCCCTAGGTG	GGATGCTGGC	AGCTATCTCT	7860
ATGGCTCTCC	ACCAAGAATG	GACTCTCTTG	ATTATCGGAA	TTGTGTATGT	TTTTGAAACA	7920
ACTTCTGTTA	TGATGCAAGT	CAGTTATTTT	AACTGACAG	GTGGTAAACG	TATTTTCCGT	7980
ATGACGCCCTG	TACATCACCA	TTTTGAGCTT	GGGGATTGT	CTGGTAAAGG	AAATCCTTGG	8040
AGCGAGTGGA	AGGTTGACTT	CTTCTTTTGG	GGAGTGGGAC	TTCTAGCAAG	TCTCCTGACC	8100
CTAGCAATTT	TATATTTGAT	GTAAGAATGG	CACCCTGATG	TTTCAGGG		8148

(2) INFORMATION FOR SEQ ID NO: 12:

(i) SEQUENCE CHARACTERISTICS:

(A) LENGTH: 9909 base pairs

(B) TYPE: nucleic acid



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(C) STRANDEDNESS: double  
(D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 12:

TACTCCACCC TTAATATCCG TTCCTGTAAA TACTTTACCG CTTTAAAGTT CATAGAATTG	60
AACTTTTAAA TGCTTGCTCT CAAGCATCTT TTCCATCCAA TTTTtaggag TTTGACCAGC	120
TTTAAATAAA AACCTTGCTG GGGTGATTAG TATAGATTTA TCTGCGATT TATAAGCTTC	180
ATCAATAAAA TAGTGATATA TCGGCTCATC TCTGGCTTCT CCTGTTTCCT GATACGGAGG	240
ATTTCCTATC ACGACATCAA ATTTCAATTC ACTTTCCTCG CTAGATAGGC GCTCAAACC	300
TATCATCTA TTTCTTTTCC AGTCTTTGAT ATGGGTTTTA GATTCTTCTA CTTCTTGGAC	360
TTCTAGCTCA TCCGCAAACA AACTCAATTG TTGAGATTGC TTTTGTtag CTGAATAAGG	420
ACTACTTTTT TTCAATCCAT CCATCTGAAA GACATTGTAA GAGATAATAG TCGCAATTTT	480
TTTCTTTTGC TCTAATGTTG GTTGATTTCC AGTCTTAGCT AGATAATAGT CCTCAAAAGT	540
TGCCAAAAGA TTCTCAGCG CCAAAGGAG AGAATCTCCT TGATACTCAT AACCATACGA	600
AGCATGATAA GCATCTTTTA CAAGTTTATA AAATGTGACT TCATCTGAAA CCTCAGCACT	660
AATCCGTTGC AGTTTTCTAT CAACAAAACC AACTCGCTCA GATAATGGAA TTTCTCACC	720
AGTTACGGTA TCATATCTCG TTACCATATA AGGTGCTTCA CCACAAGTTA CCTCTAACCA	780
TCGTAGTCC ACATACTCCT CAAGACTTAA CGAGCCTAAT TTCGATTCTA CATATCCATT	840
TTGCTTTGCG ACCAACCACG TTGGTGTAAC CACTTCTGCC CTTATTTTTG TCCGATCTTT	900
TTGTTTATAT TTGGATTTTT CAGATCTGGG CTGAATCAAG TTGGCAAAGT TTCCAGTAAC	960
CTTACTTGA TTGATGCGAT CACTTGGAGC AAATCCCTTT CCTAACAATT CATAAGAATG	1020
CGTAAGCCAA ACAATTGATT TCTTTGTCGT TCGATCTTTT AAAAGAATTT TTAATAAGTC	1080
AGCCGATTCT TTAGCCAAAC TTTCTTCACT AATATCTATT GTCATCAGCA ACCTCTCTTA	1140
TATTGTAAGC CCTATATAT CATATTTTAA AGAATGAAAA TTTACTTGAA AAAAGTAATT	1200
CAATAAATAT CTCTCCGATG ACCAACTTCT AGAGTAGCAA CGACTAATTC ATCATCTACA	1260
ATTTGTACGA TAACTCGATA ATTACCAATT CTATAGCGCC ATTGACCAAC GCGATTACCA	1320
ACCAAAGCCT TTCCGTGTCG TCTTGGGTCT TCCAAAACAT TGGTTTGTA ATAGTTTGTA	1380
ATTAGCTTCT GCGTATAACG GTCCAATTTT TTCAATTGCT TGATAAAACG TCTTGTGGA	1440
ACTAATTTAT ACAAATTATT CATCCTTCAA GCCTAAATCA TGCATCATTT CTTCCCAAGT	1500
AATGGGTCA ACTCCTTTT CCAAGTCTT TAAATACTCT TGATAGGCTA AATCTGCCAC	1560

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ACGAGCATCG TATTCATCTT CTAGGGCTTC AAGAGTTTGG GTGCGAATAA GTTCCGAAAG	1620
GGAAACTCCT TCAAACCTAG CCATTGCTTT CATAAATGTT TTATCAGCTT CAGAACTTT	1680
TAATGTAATA GTAGTCATCT TTTGTGCTCC CTTTTTTAAT GGTAACACCA TTGTATTACT	1740
TTTTAGGTGT TCAGTCAATA TAAAAAGAAC ACCTTCTCAG CGTTCTTTCT ATATCTCTGT	1800
CAATGGTGT GCGGTATCTG GTGAGGTATC ATAAACCTTA AAGTCTACTC CGACTCCCAG	1860
ATCAGCTTGA GCCAGCTGAT TGACCATGGT CATATGAGCC AGTTCCTTGA TATTGTTTTC	1920
CTTAGATAAA TGCCCCAAGT AAATCTTCTT AGTACGATTT CCTAGCGTCC GAATCATAGC	1980
TTCAGCACCG TCCTCGTTAG AAAGGTGACC AAGGTCAGAT AGGATTCGTT GTTTGAGTCG	2040
CCAAGCGTAA GAACCTGATC GCAAAATCTC TACATCATGG TTGGCCTCGA TAAGATAACC	2100
ATCCGCATTT TCGACAATGC CCGCCATACG GTCACGTACA TAACCTGTAT CTGTCAAGAG	2160
GACAAACTC TTATCATCCT TCATAAAGCG ATAGAACTGC GGTGCGACTG CATCATGGCT	2220
TACACCAAAA CTCTCGATGT CGATATCTCC AAAGGTTTGG GTTTTACCCA TTTCAAAAAT	2280
ATGCTTTTGC GAAGAATCCA CCTTGCCAAG ATATTTACTA TTTTCCATAG CTTGCCAGGT	2340
CTTTTCATTG GCATAAAGAT CCATACCATA CTTGCGAGCC AAAACGCCTA CTCCATGGAT	2400
ATGATCTGAA TGCTCATGGG TAATCAAGAT GGCATCCAGG TCTTCTGGCT TACGGTTAAT	2460
TTCAGCTAGC AGACTGGTAA TTTTCTTGCC AGACAAGCCT GCATCTACTA AAAGCTTCTT	2520
TTTTGAGGTT TCCAGATAAA AAGAATTTCC ACTGGAACCC GACGCTAAAA TACTGTATTT	2580
AAAGCCTATT TCACTCATTC TAGTCTTCTA CTTCATCCTC CCATACTTCT TCTTTCACCTG	2640
CATCCTTATC ATAAGGGAGT ACAATGGTAA AGGTTGAACC CTTGCCGTAT TCACTCTTGG	2700
CCCAATAAAA GCCCTTATGT TGTTTGATAA TTTCTTTAGC GATAGACAGT CCTAGACCTG	2760
TACCACCTTG TGCACGACTT CTAGCACGAT CCACACGATA GAAACGGTCA AAGATACGTG	2820
GTAAATCCTG CTTAGGAATC CCCAAACCGT GGTCAGAAAT GGATAAAATC ATCTGGTCTT	2880
CAGTTGTCTT CATCTGACA GTGATTTTAC CCCCATCTGG CGAATACTTA ATAGCATTAT	2940
TTAAATATTT GTCGACAACC TGCGTCATCT TATCTGTATC AATTTCCATC CAGATAGAAT	3000
TGATGGGATA ATCTCTCACC AACTCATATT TTTTCTCCTT TTCCTGTCTT TTCATCTTGT	3060
CAAAACGATT GAGGATAAAG GTAATAAAG CAGTGAAGTT AATCAGTTCC ACATCTAGGT	3120
GACTGGTAGC ATTATCAATA CGTGAAAGAT GGAGGAGATC CGTCACCATG CGCATCATAC	3180
GGTTGGTCTC ATCAAGAGAA ACCTTGATAA AGTCTGGTGC TACAGTTTCA CACAAAGCCC	3240
CCTCATCCAA GGCTTCAAGA TAGGATTTTA CGCTAGTCAG AGGAGTCCGT AACTCATGGC	3300
TAACATTGGA AACAAAGAGT CTTGTTTCGC GTTCTTCCTT CTCCTGCTCC GTCGTATCAT	3360

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GCAAAACAGC CACCAAACCT GAAATAAAGC CAGACTCTCG ACGTATCAAG GCAAAGCGAA	3420
CTCGAAGGTT CAAATATTTCG CCATTGATAT CTTGGAATC TAGCAACAAT TCTGGACTTT	3480
GGGTAATCAA ATCACGCAAT TCATAGTTTT CTTCTATCTT GAGCAATTCC AAAATGCTTC	3540
TATTCAGAAC ATCTTCCTTA ACCAACCCCA GTTGCTTCTT GGCTGTATCG TTAATCATGA	3600
TAATCTGACC CGGACGGTTA GTCGCAAGAA CCCCATCTGT CATATAAAAC AGAATACTAT	3660
TTAGCCTCTT ACTCTCTTGT TCTAGATTTT CCTGAGTGAG ACGAATAACC TCCGACAAGT	3720
CATTCAAATT ATTGGTAATA TTGGTGATTT CAGACCCACC TTGCATATCA AGAACCTTGG	3780
AATAATCTCC TGCAATCAAA TCTTTAACCT TTTGATTGAC TTGCTTCAAC TGAATATTAT	3840
CACGTCTATT TTCCAGTAAT AAGAGGGTCA CAACAAGGAT GAAACCTAAC AAAATCAGGA	3900
TAAAGATAAA ATCTCTGGTA AAAATGGTTT GTTTCAGTAA ATCAAGCATT ATTTCTCATG	3960
TAATACCTTA CACCACGGCG CGTCAAGATA TACTCTGGTC GGCTGGGCGT ATCTTCAATC	4020
TTCTCACGCA GACGTCTGAC AGTCACATCA ACTGTACGGA CATCACCAA ATAGTCATAA	4080
CCCCAGACAG TCTCAAGCAA GTGTCGCGC GTGATGACTT GACCTGTATG CGATGCTAAA	4140
TGATACAAA GCTCAAATTC ACGATGGGTT AAGTCTAGTT CTTCCGCATA TTTTITAGCC	4200
ACGTAGGCGT CTGGAACAAT TTCTAAATCC CCAATTGGA TAGGTTGAGG TTTACTATCT	4260
GCTTCCTGAC CATCTACTGG CATAGGTTGA GAACGACGCA GAAGAGCTTT AACACGCGCC	4320
TGCAACTCAC GATTGGAGAA GGGTTTGTG ACATAGTCAT CTGCCCCAAG TTCCAAACCG	4380
ATAACCTTAT CAAATPACT ATCTTTGGCT GAAAGCATAA GAATGGGCAC ACTGCTTGTC	4440
TTACGAATGG TCTTAGCAAC TTCTAAACCA TCAATTTCTG GAAGCATCAA ATCCAGAATA	4500
ATAATATCTG GTTGCTCTGC TTCAAATTGC TCTAGCGCTT CACGACCATT AAAAGCAGTT	4560
ACAACCTCGT AACCTTCCTT GGTCAATTA AACTTGATAA TATCCGAGAT TGGTTTCTCA	4620
TCATCTACAA TTAGTATTTT TTTTATATGT TCACCTTTTT CTCTACTATT ATACCAAAAA	4680
AATAGTCAGA AGACACAATA GCTAGTCTTG GCTACTGTCT AAGTTGGCTT GTGCATAAAC	4740
CTGCCAGATT TTTTGTGGG GTTTGGCAAG TGGGTAATC TTGAATTCTT CTGGTGAAAG	4800
CCAGCGAACT TCCCTATCTG AAAAATCATG GAAGTCACTC ACCTGACCTG CTACAATCTG	4860
TACATGCCAT TTTGATGAC TAAAAACATG CTGGACTGTA TCAAAACAAA CATCAAGCCA	4920
ATCAACATCT AGGTCATAGT CCTGCTGGAA ACTCTCTTCT GGACTGGGAC CAAAGTTCAC	4980
ACTTTCTTCC GCAACCTGAT GAAAGAGGTC AAATGCTCT TCTTGCGAAA AGTTATCAAC	5040
TTCTATAAAG GGGAAATGCC AAAAACCTGC CAAGAGCTTT TCGCTTTCAT TTTTITCAAG	5100

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TAAAAATTGT CCTTGAGAAT TTTTCACAAC TAAGGCTTTA AGATAAATAG GAACCGGCTT	5160
TTTCTTAGGA GATTTAATTG GATAACGGTC CATGGTTCCA TTCTGATATG CCGCACTAAA	5220
GTCCATCAAG GCTTGATTAA AATCACCCGG ACGATCCGGA TTAATCAAGA TCTCCATCAT	5280
TGCCCTGAAA ATTTTTCGAT TACTTGGAAT CCCAATATCG TGGTTGACTT CAAACAGACG	5340
CGCCAAGACC CGCATGACAT TACCATCTAC AGCTGGCTCA GGCAAGTTAA AAGCAATACT	5400
GGAAATGGCT CCTGCTGTGT AAGGTCCAAT CCCTTTCAG CTGGAATTC CTTCATAGGT	5460
ATTTGGAAAT TGGCCACCAA AGTCAGTCAT AATCTGCTGG GCTGCAGCCT GCATATTGCG	5520
AACTCGAGAA TAATAGCCCA AGCCCTCCCA AGCTTTCAGT AACTCTCCT CAGGCGCAGT	5580
TGCCAGACTT TCGACAGTTG GAAACCAGTC CAAAATCTT TCGTAGTAAG GGATAACTGT	5640
ATCCACCCTG GTCTGCTGAA GCATGATTTT AGATACCCAG ATGTGATAAG GATTTTACT	5700
TCTCCTCCAA GGCAATCTC TTTTGTTTTC ATCATACCAA GCGAGAAGTT TCTCACGGAA	5760
AGAAATGACT TTCTCCTCCG GCCACATGAC GATACCGTAT TCTTTCAAAT CTAACATATC	5820
TCTAGTATAA CACAGAAGGT TTCACCTGTC TTTGTATCTG ATTTATAATA TTTTCAATAG	5880
ATAGTATATA ACTTTTCTAT CTACTTATAC TCAATGAAAA TCAAAGAGCA AACTAGGAAG	5940
CTAGCCGCGG GTTGCTCAAA ACACTGTTTT GAGGTTGTGG ATAGAACTGA CAGAGTCAGT	6000
ATCATATACT ACGGCAAGGT GAAGCTGACG TAGTTTGAAG AGATTTTCGA AGAGTATAAA	6060
TCTTATTGAT GAACTGCTTG CAGTCTGAGA AAAAATGAGC TTGGATATTA TTTCCAACT	6120
CACTTAAAGT CAATTTCAAT CCACTAGAAC AAGCCTAGTA CAGTTCCATC GCTTTCAACA	6180
TCCATGTTGA GAGCTGCTGG ACGTTTTGGA AGACCTGGCA TGGTCATAAC ATCACCAGTT	6240
AAGGCAACGA TGAAGCCTGC ACCTAATTTT GGTACCAATT CACGAATGGT AATTTCAAAG	6300
TTTTCTGGTG CTCCAAGCGC ATTTGGATTG TCTGAGAAAC TGTATTGAGT TTTAGCCATA	6360
CAGATTGGCA ATTTGTCCCA ACCGTTTTGA ACGATTTGAG CAATTTGTGT TTGAGCTTTC	6420
TTCTCAAAGT TCACTTTGCT ACCACGATAG ATTTCACTGA CAATTTTTTC AATCTTTTCT	6480
TGGACAGAAA GGTCATTATC ATACAAACGT TTATAGTTAG CTGGATTTTC AGCAATTGTC	6540
TTAACAACGT TTTGGGCAAG TGCTACTCCA CCTTCTGCTC CATCAGCCCA GACACTAGCC	6600
AATTCAACTG GTACATCGAT TGAGGCACAG AGTTCTTTTA AGGCTGCAAT TTCAGCTTCT	6660
GTATCAGATA CAAATTCGTT AATAGCTACA ACTGCTGGAA TACCGAACTT ACGGATATTT	6720
TCAACGTGGC GTTTCAAGTT AGCAAAACCT GCACGAACGT CCTCTACATT TTCTTCAGTC	6780
AGAGCGTCTT TAGCCACACC ACCATTATC TTAAGGGCAC GAAGGGTGC GACAATAACA	6840
	6900

ACTGCATCTG GAGATGTTGG CAAGTTTGGT GTCTTGATAT CAAGGAATTT CTCAGCACCA	6960
AGGTCCGCAC CAAAACCAGC TTCAGTAACA GTGTAATCAG CCAAGTGAAG GGCTGTTGTC	7020
GTCCGCAAAA CAGAGTTACA GCCATGAGCG ATATTGGCAA ATGGACCACC GTGTACAAAG	7080
GCAGGTGTAC CGTAAATTGT CTGAACCAAG TTTGGCTTAA TAGCATCCTT CAAAATCAAA	7140
GCCAAGGCAC CCTCAACCTG CAAATCACCT ACAGAAACAG GCGTACGGTC ATAGCGATAA	7200
CCAATAACGA TATTCGCCAA ACGACGTTTC AAGTCCTCGA TGTCCGTTGC CAAGCAAAGA	7260
ATTGCCATGA TTTCTGAAGC AACTGTAATA TCAAAACCAT CCTCACGTGG AATACCGTTT	7320
AGAGGACCAC CAAGACCAAC AGTCACATGG CGGAGCGTAC GGTCTGTTCAA GTCCACAACG	7380
CGTTTCCAGA GGATACGACG TTGATCAATT CCCAGCTCAT TCCCTTGGTG CAAGTGGTTG	7440
TCAATCAAGG CAGAAAGGGC ATTGTTGGCA GTTGTAATAG CATGCATATC TCCAGTAAAG	7500
TGGAGGTTGA TGTCTTCCAT TGGCAGAACT TGTGCATACC CACCACCAGC AGCACCACCC	7560
TTGATCCCCA TGACTGGACC AAGAGACGGT TCGCGGATAG CAATCATGGT TTTCTTGCCA	7620
ATCTTGTTC AAGCATCCGC AAGACCAATG GTAAGCGTCG ACTTTCCTTC ACCTGCAGGT	7680
GTTGGGTTGA TGGCAGTAAC CAAGATCAAT TTACCGACTG GATTGCTCTC AACTGCACGA	7740
ATTTTATCAA AGCTGAGTTT AGCCTTGATC TTTCCGTACA ACTCCAAATC GTCATAAGAA	7800
ATACCAAGTT TCTCTACAAC ATCAACAATT GGCTTCAACT CAATACTCTG TGCATTTC	7860
ATATCTGTTT TCATTCAAAA TTCTCTAAC CTCTTATATG ATAATTCATT ATATCACAAA	7920
ACAAGATTTT TAACATCCTA AAACCTCTCTA AACGTTCTGA AATATCTCTG TTTTAAAGAC	7980
TTTTAGAGTC CTTTCTTAAA TTTTATATGG CTTTATAGTT TGAAACTATA ATAAATCTTC	8040
GTTTTTACCA AAAATTTATC ACTTTCATTT TACTTACCGC TTATTTTGT GTACAATAGT	8100
GCTATGAAAA TTTTAGTTAC ATCGGGCGGT ACCAGTGAAG CTATCGATAG CGTCCGCTCT	8160
ATCACTAACC ATTCTACAGG TCACTTGGGG AAAATTATCA CAGAGACTTT GCTTCTGCA	8220
GGGTATGAAG TTTGTTTAAAT TACGACAAAA CGAGCTCTGA AGCCAGAGCC TCATCCTAAC	8280
CTAAGTATTC GAGAAATTAC CAATACCAAG GACCTTCTAA TAGAAATGCA AGAACGTGTT	8340
CAGGATTATC AGGTCTTGAT CCACTCAATG GCTGTTTCTG ACTACACTCC TGTTTATATG	8400
ACAGGGCTTG AGGAAGTTCA GGCTAGCTCC AATCTAAAAG AATTTTAAAG CAAGCAAAAT	8460
CATCAGGCCA AGATTTCTTC AACTGATGAG GTTCAGGTTT TGTTCCTTAA AAAGACACCC	8520
AAAATCATAT CCCTAGTCAA GGAATGGAAT CCTACTATTC ATCTGATTGG TTTCAAACCTG	8580
CTGGTTGATG TTACCGAAGA TCATCTGGTT GACATTGCAC GAAAAAGTCT TATCAAGAAT	8640

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CAAGCAGATT TAATCATCGC GAATGACCTG ACTCAAATTT CAGCAGATCA GCACCGAGCT	8700
ATATTTGTTG AGAAAAATCA GCTTCAAACA GTCCAGACTA AAGAAGAAAT TGCAGAACTC	8760
CTCCTTGAAA AAATTCAGC CTATCATCTT TAGAAAGGAA AACTATGGCA AACATTCTCT	8820
TGGCTGTAAC GGGTCAATC GCCTCTTATA AGTCGGCAGA TTTAGTCAGT TCTCTAAAAA	8880
AACAAGGCCA TCAAGTCACT GTCTTAATGA CTCAGGCTGC TACAGAGTTT ATCCAACCTT	8940
TGACACTACA GGTACTCTCA CAGAATCCTG TCCACTTGGA TGTCATGAAG GAACCCATATC	9000
CTGATCAGGT CAATCATATC GAACTTGGA AAAAAGCAGA TTTATTTATC GTGGTACCTG	9060
CAACTGCTAA CACTATTGCA AAACAGCTC ACGGATTTGC GGACAACATG GTAACCACTA	9120
CAGCTCTAGC CCTACCAAGT CATATTCCTA AACTAATAGC TCCTGCTATG AATACAAAAA	9180
TGTATGACCA TCCAGTAACT CAGAATAATC TGAAAACATT AGAAACTACG GCTATCAGCT	9240
GATTGCTCCT AAGGAATCCC TACTAGCTTG TGGAGACCAC GGACGAGGAG CTTTAGCTGA	9300
CCTCACAATT ATTTTAGAAA GAATAAAGGA AACTATCGAT GAAAAACGC TCTAATATTG	9360
CACCCATTGC TATCTTTTTT GCTACCATGC TCGTGATACA CTTTCTGAGC TCACTTATCT	9420
TTAACCTTTT TCCATTTCCA ATCAAACCGA CCATTGTTCA TATTCCTGTC ATTATTGCCA	9480
GCATTATTTA TGGTCCACGA GTTGGGGTTA CACTTGGATT TTTGATGGGA TTAATTAGCT	9540
TGACGGTTAA CACGATTACG ATTCTACCGA CAAGCTACCT CTTCTCTCCC TTCGTACCAA	9600
ACGGAAACAT CTAAGTACGT ATCATTGCCA TCGTCCACG TATTTTGATT GGTTTAACTC	9660
CTTACTTAGT CTATAAAGT ATGAAAAACA AGACTGGTCT GATTTTAGCT GGAGCCCTTG	9720
GTTCTTGAC AAATACTATC TTTGTCCTTG GAGGAATCTT CTTCCTATTT GGAAATGTTT	9780
ATAATGGAAA TATCCAACCT CTTCTGGCAA CCGTTATCTC AACAAATTCA ATTGCTGAAT	9840
TGGTCATTTT TGCAATTCTA ACCCTAGCCA TTGTCCACG ACTACAAACC TTGAAAAAAT	9900
AAAAACAGG	9909

## (2) INFORMATION FOR SEQ ID NO: 13:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 1126 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO: 13:

TAATTTTCAT ATAATAGTAA AATAGAATGT GTGATTCAAT AATCACCTCA AATAGAAAGG	60
AAATCTATG TCAATCTAT CTGTAATGC AATTCGTTTT CTAGGTATTG ACGCCATTAA	120

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TAAAGCCAAC TCAGGTCATC CAGGTGTGGT TATGGGAGCG GCTCCGATGG CTTACAGCCT	180
CTTTACAAA CAATTCATA TCAATCCAGC TCAACCAAAC TGGATTAAAC GCGACCGCTT	240
TATTCTTTCA GCAGGTCATG GTTCAATGCT CCTTTATGCT CTTCTTCACC TTTCTGGTTT	300
TGAAGATGTC AGCATGGATG AGATTAAGAG TTTCCGTCAA TGGGGTTCAA AAACACCAGG	360
TCACCCAGAA TTTGGTCATA CGGCAGGGAT TGATGCTACG ACAGGTCCTC TAGGGCAAGG	420
GATTTCAACT GCTACTGGTT TTGCCCAAGC AGAACGTTTC TTGGCAGCCA AATATAACCG	480
TGAAGGTAC AATATCTTTG ACCACTATAC TTACGTTATC TGTGGAGACG GAGACTTGAT	540
GGAAGGTGTC TCAAGCGAGG CAGCTTCATA CGCAGGCTTG CAAAACTTG ATAAGTTGGT	600
TGTTCTTTAT GATTCAAATG ATATCAACTT GGATGGTGAG ACAAAGGATT CCTTTACAGA	660
AAGTGTTCGT GACCGTTACA ATGCCTACGG TTGGCATACT GCCTTGGTTG AAAATGGAAC	720
AGACTTGGAA GCCATCCATG CTGCTATCGA AACAGCAAAA GCTTCAGGCA AGCCATCTTT	780
GATTGAAGTG AAGACGGTTA TTGGATACGG TTCTCCAAC AAACAAGGAA CTAATGCTGT	840
ACACGGCGCC CCTCTTGGAG CAGATGAAAC TGCATCAACT CGTCAAGCCC TCGGTTGGGA	900
CTACGAACCA TTTGAAATC CAGAACAAGT ATATGCTGAT TTCAAAGAAC ATGTTGCAGA	960
CCGTGGCGCA TCAGCTTATC AAGCTTGGAC TAAATTAGTT GCAGATTATA AAGAAGCTCA	1020
TCCAGAACTG GCTGCAGAAG TAGAAGCCAT CATCGACGGA CGTGATCCAG TCGAAGTGAC	1080
TCCAGCAGAC TTCCAGCTT TAGAAAATGG TTTTtCTCAA GCAACT	1126

(2) INFORMATION FOR SEQ ID NO: 14:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 2520 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 14:

CCGGCAACAA AAAAGAAAA ATCAACAGTT AAAAAAATC TAGTCATCGT GGAGTCGCCT	60
GCTAAGCCAA GACGATTGAA AAATATCTAG GCAGAACTA CAAGGTTTGA GCCAGTGTG	120
GGCATATCCG TGATTGTAAG AAATCCAGTA TGTCCTCGA TATTGAAAAT AATTATGAAC	180
CGCAATATAT TAATATCCGA GGAAAAGGCC CTCTTATCAA TGACTTGAAA AAAGAAGCTA	240
AAAAAGCTAA TAAAGTTTTT CTCGCGAGTG ACCCGGACCG TGAAGGAGAA GCGATTTCTT	300
GGCATTTGGC CCATATTCTC AACTTGGATG AAAATGATGC CAACCGTGTG GTCTTCAATG	360

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AAATCACCAA GGATGCAGTC AAAAATGCTT TTAAAGAACC TCGTAAGATC GATATGGACT	420
TGGTCGATGC CCAACAAGCT CGTCGGATCT TGGATCGCTT GGTAGGGTAT TCGATTTCGC	480
CTATTTTGTG GAAGAAGGTC AAGAAGGGCT TGTGAGCAGG TCGCGTTCAG TCCATTGCCC	540
TTAAACTCAT CATTGACCGT GAAAATGAAA TCAATGCCTT CCAGCCAGAA GAATACTGGA	600
CAGTTGATGC TGTCTTTAAA AAGGGAACCA AACAAATTCA TGCTTCCTTC TATGGAGTAG	660
ATGGTAAAAA GATGAACTG ACCAGCAATA ACGAAGTCAA GGAAGTCTTG TCTCGTCTGA	720
CGAGTAAAGA CTTTTCAGTA GATCAGGTGG ATAAGAAAGA GCGCAAGCGC AATGCTCCTT	780
TACCTTATAC CACTTCATCT ATGCAGATGG ATGCTGCCAA TAAAATCAAT TTCCGTACTC	840
GAAAAACCAT GATGGTTGCC CAACAGCTCT ATGAAGGAAT TAATATCGGT TCTGGTGTTC	900
AAGGTTTGAT TACCTATATG CGTACCGATT CGACTCGTAT CAGTCTGTGA GCGCAAAATG	960
AGGCGGCAAG CTTTCATTACG GATCGTTTGT GTAGCAAGTA TTCTAAGCAC GGTAGCAAGG	1020
TCAAAAACGC ATCAGGTGCT CAGGATGCCC ATGAGGCTAT TCGTCCGTCA AGTGTCTTTA	1080
ATACACCAGA AAGCATCGCT AAGTATCTGG ACAAGGATCA GCTTAAGCTA TATACCCTTA	1140
TCTGGAATCG TTTTGTGGCT AGCCAGATGA CAGCGGCCGT TTTTGATACC ATGGCTGTTA	1200
AATGTCTCA AAAAGGGGTT CAATTTGCTG CCAATGGTAG TCAGGTAAAG TTTGATGGTT	1260
ATCTTGCCAT TTATAATGAT TCTGACAAGA ATAAGATGTT ACCGGACATG GTTGTGGAG	1320
ATGTGGTCAA ACAGGTCAAT AGCAAACCAG AGCAACATT CACCCAACCG CCTGCCCGTT	1380
ATTCTGAAGC AACACTGATT AAAACCTTAG AGGAAAATGG GGTGACGT CCATCAACCT	1440
ACGCGCCAAC CATTGAAACC ATTCAGAAAC GTTATTATGT TCGCCTGGCA GCCAAACGTT	1500
TTGAACCGAC AGAGTTGGGA GAAATTGTCA ATAAGCTCAT CGTTGAATAT TTCCAGATA	1560
TCGTAAACGT GACCTTCACA GCTGAAATGG AAGGTAACT GGATGATGTC GAAGTTGGAA	1620
AAGAGCAGTG GCGACGGGTC ATTGATGCCT TTACAAACC ATTCTCTAAA GAAGTTGCCA	1680
AGGCTGAAGA AGAAATGGAA AAAATCCAGA TTAAGGATGA ACCAGCTGGA TTTGACTGTG	1740
AAGTGTGTGG CAGTCCAATG GTCATTAAAC TTGGTCGTTT TGGTAAATTC TACGCTTGTA	1800
GCAATTTCCC AGATTGCCGT CATACCCAAG CAATCGTGAA AGAGATTGGT GTTGAGTGTG	1860
CAAGCTGTCA TCAGGGACAA ATTATTGAGC GAAAAACCA GCGTAATCGC CTATTCTATG	1920
GTTGCAATCG CTATCCAGAA TGTGAATTTA CCTCTTGGGA CAAGCCTGTT GGTCTGACT	1980
GTCCAAAATG TGGCAACTTC CTCATGGAGA AAAAAGTCCG TGGTGGTGGC AAGCAGGTTG	2040
TTTGTAGCAA AGGCGACTAC GAGGAAGAAA AGATGGCTCT TTGTCAACTG TAGTGGGTTG	2100
AAGTCAGCTA AGCTCGAGAA AGGACAAATT TTGTCCTTTC TTTTGTGATA TTCAGAGCGA	2160



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TAAAAATCCG TTTTTTGAAG TTTTCAAAGT TCCGAAAACC AAAGGCATTG CGCTTGATAA	2220
GTTTGATGAG ATTATTTGGTC GCTTCCAATT TGGCGTTAGA ATAGTGTAGT TGAAGGGCGT	2280
TGACGATTTT CTCTTTGTCC TTTAGAAAGG TTTTAAAGAC AGTCTGAAAA AGAGGATGAA	2340
CCTGCTTTAG ATTGTCCTCA ATGAGTCCGA AAAATTCTC CGGTCCTTA TTCTGAAAGT	2400
GAAACAGCAA GAGTTGATAG AGCTGATAGT GATGTTTCAA GTCTTGTGAA TAGCTCAAAA	2460
GCTTGTTTAA AATCTCTTA TTGGTTAAAT GCATACGAAA AGTAGGGCGA TAAAAATGTT	2520

(2) INFORMATION FOR SEQ ID NO: 15:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 10993 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 15:

TTTCTCGAT AATAACTTCC ACCTTATTAT TTGGGATACC CTCCTCTTCT TCACCACCAC	60
GTTCATAGTA GTCATCGCGA TAGAGAAAAG CTACGATATC AGCGTCCTGC TCAATAGACC	120
CAGATTCACG AATATCAGAC AAGACCGGTC TCTTGCTCTG ACGTTGTTCT ACACCACGAG	180
AAAGCTGACT CAGAGCGATT ACTGGAACCT TCAATTCTTT GGCTAGTATT TTCAACTGAC	240
GAGAAATTC AGAAACTTCT TGTGACGAT TTTCTCGACC AGTCCCGTG ATAAGTTGCA	300
AATAGTCTAT CAAATCAAA CCAAGATTTC CAGTTTCTTG AGCCAATTTA CGAGAACGAG	360
AACGAATCTC TGTAATCCGA ATACCTGGCG TATCATCGAT ATAGATACTG GCGTTAGcTA	420
GATTACCCCTG AGCAATAGTA TATTTTGGCC ACTCCTCATC TGTC AATTGC CCTGTACGGA	480
TAGAATGTGA TCCTACTAAG CCTTCTGCAG CTAACATACG ATCTACCAAG CTTTCCGCAC	540
CCATTTCGAG TGAAAAAATA GCAACCGTTT TGTCCAACCT AGTCCCAATG TTCTGAGCGA	600
TATTCAAGGC AAATGCTGTC TTACCAACTG CTGGACGAGC TGCTAAGATA ATCAACTCCT	660
CCTCATGAAG TCCTGTTGTC ATATGATCCA AATCAGATA ACCTGTCGCA ATACCTGTAA	720
TATCGGTCGT TTGTTGCGAG CGAGCTTCCA GATTTCCAAA GTTGAGATTG AACACATCTC	780
GAATGTTCTT AAACCCGCTT CGATTGTCAT TTCTACTGAC ATCAATCAAC CCTTTTCTG	840
CCTGAGCAAT AATTTATCA GCTGGTTGTG ACGCTTCGTA AGCTTGGTTG ACAGACTCTG	900
TCAACTTGGC AATTAAACGA CGTAGCATTG CTTTTCTGC AACATCTTA GCATAATACT	960
CCGCATTAGC AGAAGTTGGC ACAGAATTAA CAATCTCAAC CAAGTAAGAC AAGCCACCAA	1020

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TATTCTGTAA ATCACCTTGA TTATCAAGGA TAGTACGAAC CGTTGTTGCA TCTATGGCAT	1080
CACCACGATC GGATAAATCG ACCATGGCTT GGAAAATCAA ACGATGGGCA TACTTAAAAA	1140
AGTCCCGAGA CTCAATGTAT TCTCGCACA AAACAAGTTT ACTCTCATCA ATAAAGATAG	1200
CCCCTAAAC GGATTGCTCA GCTAAGATAT CTTGAGGTG TACTCGTAAC TCTTCTACTT	1260
CTGCCATCAG ACTTCCCTTC CTTTACAAT CTTGTCAAGA AGGTGTAAAC TTATCCTTCT	1320
TTCACACGAA GATTGATTAC ACTTGTGATA TCTTGATAGA TTTTCACTGG CACATCAATC	1380
AAACCAACCG CTCGAATCGG AGCTGTACT TGAATATGAC GTTTATCAAT CTTAATTCCA	1440
AATTGCTTTT GCAATTCTTC TGCAATCTTC TTATTGGTAA TAGAACCAA GGTACGACCA	1500
TCTGGACCAA CTTTTCAAC AAATCTACA ACAGTTTCTT CTGCTTCAAG TTGTGCTTTA	1560
ATTGCTTTTC CTTCTGCAAT CATCTCAGCG TGAGCTTTT CTTCCGATT TTGTTTACCA	1620
CGAAGTTCAC CTACAGCTTG AGCAGTCGCT TCTTGGCTA GATTCTTTT GATAAGAAAG	1680
TTTTGCGCAT ACCCTGTTGG TACTTCCTTA ATTTGCGCTT TTTTACCTT TCCTTTAACA	1740
TCTGCTAAAA AGATTACTTT CATCTCTCT TCTCCTTTTC CTTCAATTCA TTTAATACAA	1800
TTTCTGTGAG TTTTTCACCT GCTTCTGACA AGGTTACATC TTTAATTGA GCTGCTGCCA	1860
AATTAAAGTG GCCTCCACCG CCTAACTCTT CCATAATCCG TTGTACATTC AGTTTACTAC	1920
GACTTCGAGC TGAGATAGAG ATAAATCCTT GTGTATTCTT CGCAAGAACA AAACGCTT	1980
CAATACCTGA CATGGCTAAC ATGGCATCTG CTGCTTACT AATAACAACT GTATCATAGC	2040
ATTCATGTC CTTAGCCTCT GCTATTAGTA CATCTGAACC TAATTTACGC CCCTGTAAAA	2100
TAAGTTCATT GACCTCACGA TATTCTTCAA AATCTGTCGC AGCGATTTC TGGATAGCAA	2160
TACTATCACT TCCGCGCGTT CTGAGATAGC TAGCAACATC AAATGTCCGA CTAGTTACTC	2220
GCGAGGTGAA ATTTTGTAGT TCCAACATCA TACCAGCCAT CAAGACACTT GCTTGCATAC	2280
GACTCAAACG ATTTTCTTA GAATTCTGGA ACTGAATCAA TTCCGTTACC AACTCACTGG	2340
CACTACTTGC ACCACTTTCG ATATAAGTAA TAACCGCATT ATCTGGAAAA TCCTGATCCC	2400
TTCTATGGTG GTCAATAACA ATGGTTTGGG TAAATAAATC ATAAATTTCT TTTGATAATG	2460
TTAAGGCTGT CTTTGAATGG TCTACAAGAA TCAACAAAGA ACGATTGGTC ACCATCCCCA	2520
TTGCATCCTT AACAGACAAC AACTTCGTAA CTCCTTCTTT TTCTATGAAT GAAACAGCTC	2580
GTTCATATC TGGAGACATT TGTCTTCAT CATAAGAGC ATAGCTATTT TCAATCACAT	2640
TGCTGGCGAA CAACTGCATA CCTACAGCAG AGCCCAAAGC ATCCATGTCT AAATTTTGT	2700
GACCGACTAC AAAAACCTGA TCTACACTCC GAATCTTATC TGAAATAGCT GTCATCATAG	2760
CGCGCGTACG AGTCCGTGTA CGCTTGATTG AAGCAGCAGA CCCACCACCA AAATAAACTG	2820

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AGTTCAAAT GAGCAAAGCA ACTTTCCTTA TCTCATCATG ATTTCCATCG CCATAAGAAA	2940
ATCCCATACT TAAGGTCAAG GGCAACTGTC TCTGTTTCGA CTCTTCTCTG AAAGCATCAA	3000
TAACAGAAAA TTTATCATTC ATCAAGCCCT CAAGCACCGT GTAGTCAGTA AATAGATAAA	3060
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AATTAGCTAC AAAACTATTG ATTTGACTAA TATCTGACTC AGAAGTTTCA TCCTCCAAAT	3180
CATCATAATT ATCCACAGAG ACAATCCCAA TCACTGGTCT ACTTGTACC AATTCATCTG	3240
TTATGGCTTG TTCCTGGAT ACATCTACAA AATACAAAAC ACCGGAAGAA GCATCCATAT	3300
GAACAGCATA ACGCTTCTCA CCAAGCTTG CATAAGTAGA CGGATTTCTT ACTGAAGCCT	3360
TGATAATCGT TTGAACAGCT TCTAAATCAA AATCACCATC TTCCTTGGTC AAAATCAATT	3420
CAGCATAGGG ATTAAACCAC TCAACCTCTC CAGAAGATAA ATTCAATTTT ATAACACCTA	3480
CAGGCATCTG TTCCAATAGA GCTGTCAAAC TTTCTTCCGC TTGGTGGTTT ACATACTGTA	3540
TCTGTCTAC ATCACTCCTT GTATAATGCA CTCTCAGTTT CTTAAATAAA AAAACATAGC	3600
CTCCTACAAA AAGAAACAAA ATTAAACCG TCAACAGATT ATTATTAACA AAAATAATGA	3660
AAGTGGATAA GACTCCAAAC GCAATCAATC CTAAGTAGAAT AGGAAAAATT GGACTTACAT	3720
AAAATTTTTT CATTCAAAC CTCTTGGCAC CCATTATACC ATAATACCCC TCAAAAAGCG	3780
ACTTTTAAA AGTGTAATCA GTAATTCTAT CAATTATAAG AAAAAGGTAG TTTACAATTC	3840
AGTAAACCTA CCTTTACACA TATTGAAATT AAGATTCTTT AACCTCTAAC AAACCAATTT	3900
CGCCATCCTC ACGACGATAA ATCACATTGG TTGTCTGATC TTCAACATCC ACATAGATAA	3960
AGAAATCATG CCCCAATAAA TCCATTGTGA GAATTGCTTC TTCCAAATCC ATGGGTTTTA	4020
AATCAATTTG TTTTGAACGA ACAACTTTAG ACTGGACAAT ATTTGAATCT TCCACCAAAG	4080
CATCTGTAAA TAATTGACCA GTTGCTACCT TATTTTATT TTTACGCTCG ATTTTGTTTT	4140
TATTTTACG AATCTGACGT TCAATTTTAT CAGTTACAAG GTCAATTGAA CCATACATAT	4200
CTTGAGATAC ATCTTCTGCG CGGAGAGTAA TAGATCCAAG CGGAATCGTT ACTTCCACTT	4260
TAGCCGTTTT TTCACGATAA ACTTTAAGT TAATTCGGGC ATCCAACCTCT TGTCTGGTT	4320
GGAAAGTACTT TTCGATCTTT TCGAGTTTAG AAACCTACATA ATCACGAAT GCTTCTGTTA	4380
CTTCTAGGTT TTCACCACGG ATACTATATT TAATCATATG AGTACCTTCT TTCTAAACAT	4440
TTTGTTTTT ATGATTTTAT TATAACGCTT TCATTCTATT TTTGCAAATT TTTTCTCAT	4500
CTTACAAGGG AAAATGTTTT TACATCCTTA GCACCAGCTT CTTCCAACAG TTTCTTAACA	4560

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CGATTATAG	TTGCTCCTGT	AGTATAGATA	TCATCTATAA	GTAGGATTTT	TTTAGGAATA	4620
GTGACTCCAC	TTTTAATAAA	GAAAGGAAGT	TCTGTCCCCA	AGCGCTCTGA	ACGATTTTTA	4680
GAAGAACTGG	CTCTCTCTTC	TCTTTTCTCT	AATAAATCCA	GATACTCAAA	GCCTGCTGCC	4740
TCTACCAAGC	CCTCAACCTG	ATTAAATCCT	CTATTAGCAT	ATCTATCAGG	ACTTAGGGGA	4800
ATTACAACAA	ATTGATACTC	TTTGTACTTT	TTCAACTCCT	CACCTAAAAA	TGAAGCGAAA	4860
ACTTTTCTTA	ACAGGAAGTC	TCCATCAAAC	TTATACCGAC	TGAAAAATC	CTTCATAGCT	4920
TGATTGTAAG	TAAAAATCGC	TCTATGACTG	ACTTCAACTC	CCTCTTTACA	CCAAAGTTGA	4980
CAATCTTGAC	ACTTTGTGTA	CAACTCTGTT	TTCATACAAT	TTGGACAGTT	CTCTTCCCCA	5040
ATTCTTTCAA	AAGTAGAATC	ACAGTCTGAA	CAAAGACAAG	AGTCATCATT	CCTCAGAAGT	5100
AAGAGACTAC	TAAAAGTTAA	AACAGTCTTC	ATAGTCTGCC	CACATAACAA	GCACTTCATA	5160
GACCAGCCTC	CTTATTTCATC	ATCTGAATTT	CCTTAATCGC	CTTCTTGATT	GAAGCATTTA	5220
ACCCATCATG	GAAGAAAAGC	AAATCTCCTG	TCGGTCTATC	CATGCTTCGT	CCAACTCGTC	5280
CACCAATCTG	AATCAAACCTA	GACTTGGTAA	ACAAACGATG	ATTGGCCTCT	ACTACGAAAA	5340
CATCCACACA	AGGGAAGGTA	ACTCCGCGCT	CCAAGATTGT	CGTACTGATA	AGTATTGTCA	5400
GTTCTCCATC	TCGAAAAGCT	TGTACTTGCT	CTAATCGATC	CTCTGTTACA	GAAGATACAA	5460
AGCCAAATTT	CTCATTTGGA	AATTGCTCCT	GTAAGATTTC	TGCTAACTGC	TCCCCTTTCT	5520
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TTGGTTTGG	AATAATCAAC	GGATTTCAT	GAAACCGTCT	CGGTAAATTC	AGTCTTTTTA	5700
GTTCTCCTAA	ACGGACCTTT	TTATCTAACT	CATTGGTCGA	AGTCGCTGTT	AAAAAGATTTC	5760
TCAATCCATT	CTCCTTTACA	CTATTCTTGA	CAGCGTGGTA	AAGCATGGGA	TTATCAACAT	5820
AAGGAAAAGC	ATCTACTTCA	TCCACTATCA	GCAAATCAAA	AGCTTGATAA	AACTTCAATA	5880
ACTGATGGGT	TGTTGCAACA	ACTAGTGGTG	TTGCAAAATA	AGGTTCCGAT	TCTCCATGTA	5940
GCAAAGCTAT	CCCGCAAGAA	AAATCCTGTT	GCAGGCGCTT	GTACAGCTCC	AAACAAACAT	6000
CTATGCGAGG	ACTAGCCAAA	CACACTGCAC	CACCCGATT	GATCACTTTA	GCCACTACTT	6060
GATAAATCAT	TTCTGTCTTT	CCAGCTCCTG	TTACCGCATG	AACTAAGGTT	GGCTTTTGCT	6120
TGTCTACTAC	TTGAAGCAAT	CCCTCTGACA	CCTTCTCTTG	AAAAGGAGTT	AATTGGCCGC	6180
GCCATTTGAG	AACATCTTGC	TTTGGAATAA	CCTCCTGCGG	AAAATAGTAT	AAAGTTTGAT	6240
CACCTCTGAC	TCGCTTCATC	AGCAAGCACT	CTCGACAATA	GTAAGCACCG	ATGGGCAAAAT	6300
ACCATTCCTC	TAGAATAGTA	CTATTACAGC	GTTGACAGAA	AAGTTTCCCC	TTCTCCTTTC	6360

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ATAAACGACC GAGATAATCT AAATTTACTT TCATACTTCT TTATTCGTAA AAAC TAGCAC	6480
TTTAGATGAT TTTTAGTAC AATTAAATCA TGGAATTTAG GACAATTAAA GAGGACGGTC	6540
AAGTCCAAGA AGAAATCAAA AAATCTCGCT TTATCTGCCA TGCCAAGCGT GTTTATAGCG	6600
AAGAAGAGGC TCGTGACTTC ATTACTGCCA TCAAAAAGA AACTACAAA GCGACACATA	6660
ACTGCTCTGC CTTCAATTATT GGAGAACGTA GTGAAATTA ACGTACAAGT GATGATGGTG	6720
AGCCTAGTGG TACTGCTGGT GTTCCCATGC TTGGGGTACT AGAAAATCAC AATCTCACCA	6780
ATGCTCTGTG GGTCTGTACA CGCTACTTTG GTGGTATTAA ACTAGGCGCT GGAGGACTAA	6840
TTCTGTCTTA CGCCGGCAGT GTCGCCTTAG CTGTCAAAGA AATTGGTATT ATTGAAATAA	6900
AAGAACAGGC TGGCATTGCT ATTCAAATGT CTTATGCTCA GTACCAAGAG TACAGTAACT	6960
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TGATTTATGT TGATAAAGAA GAAAAAGAAA CTATTAAAGC TGCACCTGTG GAGTTTTTTA	7080
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TGTAACAAT GAATAATACA GCGTTTCGTT GACATTCTCA CAACTACTTT AGCGAGCAAA	7200
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CGTTTTCTTT CACACCTATT TACTAGAATT AGCTGAACGC AATCACTTGA AAATTAATGA	7320
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AAGAGGTATT CATATGTCTA TTTATAACAA CATTAAGTAA TTAATCGGTC AAACACCGAT	7440
TGTTAAACTT AACAACATCG TGCCAGAAGG TGCTGCAGAC GTCTATATAA AGCTTGAAGC	7500
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ACAAGATGGT ATTCTGAAAC CTGGTTCTAC TATTGTTGAA GCAACAAGTG GAAACACCGG	7620
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AACAGGAGCT GAGATACTAG CTGCTTTCGG TAAAGATGGA TTAGATGCCT TTGTTGCTGG	7920
AGTAGGTAAT GGTGGAACGA TTTCTGGTGT TTCTCATGCA CTCAAATCAG AAAATCTTAA	7980
CATCAAGTT TTTGCAGTAG AAGCAGATGA ATCTGCTATT CTATCTGGTG AAAACCTGG	8040
TCCTCACAAA ATTCAAGGTA TCTCAGCTGG ATTTATTCCT GATACACTTG ATACTAAAGC	8100

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CTATGATGGT ATCGTTCGTG TAACATCAGA TGACGCTCTT GCACTCGGAC GTGAAATTGG	8160
TGGAAAAGAA GGCTTCCTTG TAGGGATTTC CTCAGCTGCA GCTATCTACG GAGCCATCGA	8220
GGTTGCCAAA AAATTAGGTA CAGGTAAAAA AGTCCTTGCC CTAGCACCAG ATAACGGTGA	8280
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TTCCACGTTT GGAAGACATT CTAGAAGATA GGATAGATAT TTCTCACTAT TTATAATGGA	8520
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TCAGCTTTCC CAGACAAAAA AGTCCAATAG TAAGTCAGCT GACTATCACT CTCTAGCACC	8640
CTATAAGAAG TTTTCATCCGC ATGAAGTAAG GGCTGAGTCA ATAGTCTCTC TCGCAAGAGG	8700
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CGTGTGATTG GTAAACCCAT CCTAGCCCAA TCTTCTTCTT GCGGATAATT GGGTACCTTC	8820
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AAAGGGGCTT TAGGAATAGG AGCTTTCACA AGCTTATCCA GATGATTATC TTTTACTCGT	8940
TATGGACAAAT GCTATATGGC ATAAATCAAG TACCTTAAAG ATTCCGACTA ATATTGGCTT	9000
TGCATTTATT CCTCCATACA CACCAGAGAT GAACCCCATT GAACAAGTGT GGAAAGAGAT	9060
TCGTAAACGT GGATTTAAGA ATAAAGCCTT TCGAACTTTG GAAGATGTCA TACAAGGACT	9120
GGAGAAGGAG GTGATAAAGT CCATCGTTAA TCGGAGACGG ACTAGAATGC TTTTGGAAAA	9180
CAGATGAGTA TAAAAGAAA GTCTCATTTT CAATAGAAAT CACGACTTTC TGATGAATTT	9240
ATAGTAAAT GAAATAAGAA CAGGATAGTC AAATCGATTT CTAACAATGT TTTAGAAGCA	9300
GAGGTGTACT ATTCTAGTTT AAATCCACTA TATTGGGGA GTGATAGAAA AGCCCTTCAT	9360
CAGCCAATCT ACTTGTTTCTG GTGCGAGAGC TTTGACATCC TTTTCTGTAC TGGACCAAGT	9420
CAGTTTTCCG TTCTCAAAGC GTTTATATAA TATCCAAAAT CCTTGACCAT CCCAGTAAAG	9480
AACTTTAAAG CGGTCTTTAC GTCCACCACA AAAGAGAAAG ACTTGATCGG AGAAAGGATC	9540
CAATTCAAAG TGGGTTTTAA CTACATAGGC TAATGAGTCT ATTCCCTGCC TCATATCTGT	9600
CTTGCCACAA ACAAGGTGAA CTTGACCTAA ATCACTTAGT TGAATTATCA TAGTACAATA	9660
CCTTTCCTCC GATAATTATT TTTTATCTGG TATACTGGAA GTTGGGGAAT TAGGATAGAT	9720
ACCTTGTTAT GACGCGCTTA CTATGAATTT GAAGTATAGT CTCCTAAATG CACTTAGCCC	9780
TTATTATAGG GCTTTTTGTT TTAATTATTC TAATCGAGTG AGACTGGGGA AAAACAATT	9840
TCAGGAAAAA TCTAAGCCCT ATACAAAAA GGAAGCAATT TGCTTCCTTT CTATTATTAG	9900

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TTATTCAAGG CTGCTGCCAT TGTAGCTGCA ACTTCAGCTT CGAAGTCGTT TGCAGCTTTC	9960
TCGATACCTT CACCAACTTC AAAGCGAGCA AACTCAACTA CCGAAGCGTT AACTGATTCA	10020
AGGTATGCTT CAACTGTCTT GCTGTCAATCC ATGATGTAAA CTTGTGCAAG AAGTGTGTAA	10080
GCTTGGTCAA CTTTAGTGTT ATCAAGCATG AAGCGATCCA TTTTACCTGG AATAATTTTG	10140
TCCCAGATTT TTTCTGGTTT GCCTTCTGCA GCCAATTCAG CTTTGATGTC AGCTTCAGCT	10200
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GGTTTATTAA CCATTGCACG GCTTTCGTTG TCTTGGTCGA TAACGTGATT CAATTGTGCC	10320
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GCTGGGATGT GCATTGACAA TTGTTTAGCA AGTGTCTCGT CTCCACCTTC AACAACTGAA	10440
ATAACACCGA TACGTCCACC GTTATGTTGG TATGCTCCAA AGTGTGTGTC GTCTGTTTTT	10500
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TATGCAGCTT CAAGAGTTTC ACCTGAAGGC ATTATCAAAG CAAGAGCTTC TTCGTTGTTA	10620
GCAGGTTTTC CTTTCAGCAAT GACTTTAGCT GTAGTATTTA CCAATTCAAC GAATTGAGCG	10680
TTTTTTGCAA CGAAGTCAGT TTCAGCGTTT ACTTCAATAA CTGCTGCAAC ATTACCGTTA	10740
ACATAAACAC CAGTCAAACC TTCTGCAGCA ACACGGTCAG CTTTCTTAGC TGCCTTAGCC	10800
ATACCTTTTT CACGAAGCAA TTCAATCGCT TTTTCGATGT CACCGTCTGT TTCTACAAGC	10860
GCTTTTTTAG CGTCCATAAC ACCGGCACCA GATTTTTTAC GCAACTCTTT TACAAGTTTA	10920
GCTGTAATTT CTGCCATTTT AATTCTCCTA TATTTTTTGA AAATAGGAGA GCGCGGCTAA	10980
GCCCCGCCTC CGG	10993

(2) INFORMATION FOR SEQ ID NO: 16:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 8411 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 16:

CGACGGGGAG GTTTGGCACC TCGATGTCGG CTCGTGCGAT CCTGGGGCTG TAGTCGGTCC	60
CAAGGGTTGG GCTGTTGCGC CATTAAAGCG GCACGCGAGC TGGGTTTCTA ACGTCGTGAG	120
ACAGTTCGGT CCCTATCCGT CGCGGGCGTA GGAAATTTGA GAGGATCTGC TCCTAGTACG	180
AGAGGACCAG AGTGGACTTA CCGCTGGTGT ACCAGTTGTC TTGCCAAAGG CATCGCTGGG	240

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TAGCTATGTA GGAAGGGAT AAACGCTGAA AGCATCTAAG TGTGAAACCC ACCTCAAGAT	300
GAGATTTCCT ATGATTATAT ATCAGTAAGA GCCCTGAGAG ATGATCAGGT AGATAGGTTA	360
GAAGTGAAG TGTGGCGACA CATGTAGCGG ACTAATACTA ATAGCTCGAG GACTTATCCA	420
AAGTAACTGA GAATATGAAA GCGAACGGTT TTCTTAAATT GAATAGATAT TCAATTTTGA	480
GTAGGTATTA CTCAGAGTTA AGTGACGATA GCCTAGGAGA TACACCTGTA CCCATGCCGA	540
ACACAGAAGT TAAGCCCTAG AACGCCGGA GTAGTTGGGG GTTGCCCCCT GTGAGATAGG	600
GAAGTCGCTT AGCTTTAATC CGCCATAGCT CAGTTGGTAG TAGCGCATGA CTGTTAATCA	660
TGATGTCGTA GGTTCGAGTC CTAATGGCGG AGTAATGAT AAAAGGGAAC ACAGCTGTGT	720
TCCTCTTTT GTATCAATTT GTATCACCAA GCATTTTCAT AAGGAAGTCT GTTATTTCTT	780
GAGAACTTTC TTTTTCCTCA TGTGAATCC AAGTTTGGA GACACCAAAA AGTGCATGAG	840
TTAGATAGAT GCTACTATAT TCTAATTCAG TGGTATTTAG ATTCAAGTTC ATAAATCGCT	900
TTTGTAATC TGTACTAAGC ATGATATGAA GTTTATTTTC TAAGAAATTT TGGATTTCTT	960
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CTTCTAAAA AGCGTCTCTT TTGTGATGAG CATGTTTTTG AAAAATATAT TCAATGTAT	1080
GGAATAGCTT GCTTTGATAG TGCTCAATCA TATCATACTT ATCCTTATAG TGAGTATAGA	1140
AGCTGGAACG ACTAATTCAG GCTTTTCTA CTAATTTGAC AGTAGAAATT TTATCAATG	1200
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ATATGTTTAA AAAAGGAGAA ACTAAGTTTA AAGAATGGAA AGCAATTTAA AAAAAACCA	1440
CCTTTATTAT TGTCATGATC GGGATTTCTC TTATTCAGA TCTGTACAAT ATCATATTTT	1500
TGTCATCAAT GTGGGATCCA TATGGGCAAT TGCTGACTT ACCTGTGGCA GTTGTAATA	1560
ATGATAAAGA GGCTTCCTAT AATGGTAATA CTATGGCAAT AGGAAAAGAC ATGGTGTTCA	1620
ATTTAAAAA AAATAAAACC TTGGATTTTC ATTTTGTAGA TGAAGAGGAA GGAAAGAAGG	1680
GATTGGAAGA TGCGGATTAC TATATGGTAG TGACTTTACC AAGTGATTTA TCTGAAAAA	1740
CAACTACATT ATCCAATATT CAATCGACAG CAGCTTATCA ATCATTGACA AGTGAGCAAC	1800
AACTGAGAT AAGTGATTCT GTATCTCAA ATTCAACTGA TAGTATTCAA TCGGCTCAGT	1860
CAATTGTAGC TTTAGTACAA GATTACAGG GAAGTTTGA AACTTTACA AATCAATCTT	1920
CTAATCTTTC GACTTTAAAA AATCAATCTA ATCAAGTATC ACCTATTACT TCTACTTCTT	1980
TGATAGGATT GTCAAGTGA TTAACAGAGA TACAAGGAGA TGTTACTAGC AAATTAGTTC	2040



CTGCCAGTCA	GTCGATTGCA	TCAGGTGTAA	ACGCATATAC	TACAGGTGTT	GATAAAAGTTT	2100
CTCAGGGCGC	AAGTCAACTA	AGTGAAAAAA	ATGCCACCTT	GACAGGTAGT	TTGGATAAAC	2160
TAGTTTCAGG	CTCAAACACC	TTGACACAAA	AATCTTCTAG	ATTGACAGCA	GGAGTTGGTT	2220
AATTACAATC	AGGATCTGGG	CAATTAGCAG	ACAAATCCAG	TCAGTTACTT	TCAGGTGCTT	2280
CTCCATTAGA	GAATAGAGCT	AATAAATTGG	CAGATGGATC	TGGGAAACTA	GCAGAAGGTG	2340
GAACAAAGTT	AACCTCTGGA	TTGGAAGATT	TACAGACAGG	ACTTGCTTCT	TTAGGACAAG	2400
GACTAGGTAA	TGCTAGTGAT	CAACTCAAAT	CAGTATCAAC	AGAATCTAAA	AATGCAGAGA	2460
TTTTGTCAAA	TCCACTCAAT	CTTTCAAAAA	CAGACAATGA	TCAAGTTCCT	GTAATGGAA	2520
TCGCAATAGC	TCCTTATATG	ATATCAGTTG	CTCTTTTTTT	GCAGCAATAT	CAACAAATAT	2580
GATATTTGCG	AAATTGCCCT	CAGGACGTCA	TCCAGAGAGC	CGTTGGGCTT	GGTTGAAATC	2640
TTGAGCTGAA	ATAAATGGTA	TTATAGCTGT	TTTGGCAGGA	ATTTTGGTAT	ATGGAGGAGT	2700
TCAGCTTATT	GGTTTAACTG	CTAATCATGA	GATGAGAATA	TTTATTCTCA	TCATCCTAAC	2760
AAGTTTAGTA	TTCATGTCTA	TGGTGACCAC	TTTAGCAACG	TGGAATAGCC	GTATAGGAGC	2820
TTTTTTCTCA	CTTATTTTGC	TTTTACTACA	GTTAGCATCA	AGTGCAGGTA	CTTATCCACT	2880
TGCTTTGACA	AATGATTTCT	TTAGATCTAT	TAATCCCTGG	TTACCAATGA	GCTATTCTAGT	2940
TTCTGGGATTA	CGACAAACAA	TCTCTATCAA	CAAGTCATTT	TCCTAGCTGT	CATACTAGTT	3000
CTATTTACTA	GTTTAGGTAT	GCTAGCCTAT	CAACATAAGA	AAATGGAAGA	AGATTAAAAA	3060
AATCGACCGA	TTAACTGGTC	GATTTTTTAT	GCCTTAGATG	ACTTTCGTCT	GTGATTATAG	3120
ATTCCAAATA	GTAAGAGAGA	AGTAAAGGAA	CAGATTGCTC	CAGTAATAAA	ACCATTGGGA	3180
ATGAAGGAAA	GTGTAATAGT	TCCTTTCCCC	TTGGGAATGT	CAACTTTCAT	AAATCCAGTT	3240
TGAGCTTGTT	TAATTTCTAT	TTTCTTACCA	TCTTGGTAGG	CAGACCAACC	TTTGTCTATA	3300
GGAATGGTGA	AGAAAATAGA	TGTATCTTGT	TGGACATCAT	ATGTAGCAAA	AACCTTGTTT	3360
TTAGAAGTTG	ATACTGTGAC	AGGTGTCTCT	TTAATTTTTT	GAATTGCCTC	GGTGAAAGTT	3420
TTGGTATCTA	AACGATAGAA	GGTAGGAGAT	TCAAATGATA	CTTGTGAATT	TCCAGGGAAA	3480
CTAACATTGA	TATGAAAGT	TTTTTTCTCT	TTAGTATATC	CTAGATTAAA	GAAGGAGAAG	3540
ACATTATCAG	TTGTAAAAGT	CTTTTTTTCA	CCATTTACAA	GGATGTCAAC	CTTCTTTTGT	3600
TTATCGTTAG	AAAAGTGAAG	GTTTATGAAA	GAGAGATAAA	CTTGGCTGTT	TTCTGGAAC	3660
TCAATTTGAT	ACTGGATTGC	TGCATCTTCA	TTTGAAGAAC	TTGTGACACT	AATCAAATCA	3720
TTAGTATTTT	CTATTTTTTC	TGTTTTTTCA	TAAGGTATTG	GAGAAAAATA	ATCAAAATTG	3780

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ACGTTAGCAA GTTGATTTAA AAATGAGGCC TGATTATCCA AGGTATGTTT ATTGAACCTG	3840
ACATCATTTGT AAACAGATTG ACTCGCAACT GCAATCGGAA GAGAGTATTG ATTTTCATAT	3900
AGGGTAAGAT TATCTTTTGT ATAGATATCT TTAAAGCCAT ACTTATCAAT AGGACTGTCT	3960
GAGATATTGT ACTGGATACC AAATAAACTA TCAGCCAAAA TACTATTATT TGCATATCGG	4020
AGATTGAGAT TAGTCCCAGA GGATTTAAAA CCAAGTTTAT CTAAGTAGA GCTTGATGAA	4080
CGATTTTCGAA CAGATGAAAA TTGAGAGATT CCATTGTAGT TGAATTTTCAT ACTGTCATTT	4140
CCTGTCTGAG TTTGTAGTTT TTCAGTACGA GTAAATTGAT TTCCAATATA TGTGAGAAA	4200
GATTCCATAG CTGGGATATC TCGACTATAA GCACTTCGAG AAGCAAAATCC CCATTCCTTA	4260
GCAATTCGGT CCATTTGAGA TGAAGCATTT AAATCATT TTCAACAGTAT AAATAAGAG	4320
ATTAGAATGG CAAATAGATT CACAGATATA AACTTTTGA TAACTGCAAG GAGTAAAGA	4380
GAATAGACAA CCAAAAATTC AAGAGTAAGC AGAATATTCA AATCTGTAA AAAAGAATAA	4440
TGCGATTTTA GATAGATGGT AGCTAAAAAT CCTGCTACTA CAAGAAAAAG CGAACTAAA	4500
AAATTCAGCA CTTTAAGTTC TTCAGACGC TTTAAGACTT CTGCTGCTGT GTAAATTAAC	4560
AAGGTAGAGA AAATCCAAGC ATAGCGATGT AAAACATGT TTGGAGTATG CATGCCTTGC	4620
CAAATAAGT CAAGAGCTTC TATGTAAAAG CTTGCAATTA GAAATGCAA GAATATTACA	4680
TATATGAGTT TCACGTGAAA CTTAATAGAT TTCAGCGTAA AAAATAAAAT GGTCAAATA	4740
AAGGGAATA GTCCAACAAA AATCATTGGG ATGGCCCAT ACTTTGTTGT GTCAAAGGAA	4800
CCAATGAATT GCTTAGCAAA GAGATCAAGA TACCAGCTAC TTTCAGTTTG AAATTTGTA	4860
ACTTCAGTCA ATTTTCCCC ATGTGTCTGT AAATCAAATA GAGTGGGAAG AGTCATAATC	4920
AACTAGCCA TACCAGCTAA AAAGGAGATA ACTATGAAAT CAAGAACAGA TGATTTTCGA	4980
GTCTTAAAGT CCCACGAAAT TTGACAGAGA TACCAGAAAA TAAGAAACAA TACTGTCATA	5040
TATCCAAAAT AATAATTTTG AATAAATAAG ATTGACAGAC TTGTAAAGTA CAATAGGAGT	5100
TTCTTTTCAG TTATCAGTAG ATGTAAACCA GTTATAATTA AAGGAATCAA GATAAAAACA	5160
TCTAGCCAGG TTTTATCTC TAATTGACTG ACAGTGAAC TCATCAGAGC ATAGGAAGTA	5220
GATAAGGCTA GTTTTAAAT CTGAGGGATA GATTGAAACA ATTTATTCAA ACTAAAAAG	5280
GTTGACAGAC CAATCAATCC AAATTTTAAG AGAGTTGTCA GATAGATAGC ATCTGGCATA	5340
TTCGTTAGAT CAAAAAGTA AACCAGAGGC GCGAGAAAC TACCAAGTA ATAAC TAGAT	5400
AGGGCATAGA AGTTTAGCCC TAGACCACTT GTAAAGGTGT AAAACAGATT ACTATTTCCA	5460
TGTAGGATAT TTCGTAAGGC TACATCAAAA ATAACGTATT GATGAAAGCC ATCTCCTAAT	5520
AGAGGAGAGT TGTCGCTATT CCAGTAGATA CTTTGAGATA GATATACTCC AGACATAATC	5580

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ACTACAGGAA TGATGAAAGA AATAAAATAG GTTCGATATG TTTTAAAAA TGATTTCATG	5640
TTACCTCGTA GAATGATAGA AAACCTCAGTT GGTAAACCCA ACTGAGTTT GAAGTTTAT	5700
TTAGTCTTTC CAAAGTTCTT TAACTTTTCG TGTACTTCT GCATTTTCTA GGAATTCATC	5760
GTAGGTTTCA TCGATACGGT CAATGACGCC ATTTTGTAGT AAGACAATGA TATGGTTAGC	5820
CAAAGTTTGA ATAAATTCGT GGTCTGGCT GGCAAAGATG ATTGATTCTT TAAAGTTTTT	5880
CAATCCATCA TTCAAGCTTG AGATAGATTC CAAGTCCAAG TGATTGTGTG GATCATCAAG	5940
TACAAGGACA TTTGATTTTA AGAGCATGAG TTTTGAAAGC ATGACACGAA CTTTTCTCC	6000
CCCTGACAAG ACATTTACAG GTTTGTTAAC TTCATCTCCA GAGAAGAGCA TACGGCCGAG	6060
GAAGCCACGT AGGAAAGTAT TGTCTCTTC TCTTTTACTT GCGAATTGAC GCAACCAGTC	6120
AAGAATTGAT TCTCTCTCTG CAAATCAGC TGAGTTATCT TTTGGTAGGT AAGATTGACT	6180
AGTTGTAAC TCCCTCTGA CAGTTCCTTC ATAGTCAATA TCTCCCATGA TTGCACGAAT	6240
TAATGCAGTC GTTTGAATAT CATTTTGTCC AATAAGTGCT GTCTTATCAT CTGGACGCAA	6300
GATGAACTA ATATTATCCA AGATAGTTTC ACCATCAATC TTTACAGTTA AATTTCTAC	6360
TGTCAAGAGA TCATTACCAA TCTCAGTTC CGCTTAAAG TTGATAAATG GATATTACG	6420
ACTAGATGGC ACAATCTCTT CTAGCTCAAT CTTATCAAGC ATTCTCTTAC GTGATGTTGC	6480
CTGCCTTGAC TTAGAAGCAT TGGCAGAGAA ACGAGCAACA AATTCTTGCA ATTGTTTAA	6540
TTTTCTTCT GCTTTAGCAT TACGGTCTGC TAGCAATTTA GCAGCAAGCT CAGAAGATTC	6600
CTCCAGAAG TCGTAGTTTC CGACATAGAG TTTGATTTTT CCAAAGTCAA GGTCCGCCAT	6660
GTGAGTACAA ACTTTGTTTA AGAAGTGACG GTCGTGGGAT ACTACGATAA CTGTGTTATC	6720
AAAGTCAATC AAGAAGTCTT CTAACCAAGT AATCGATTGG ATATCCAAAC CGTTAGTAGG	6780
CTCGTCCAAG AGAAGAACAT CTGGTTTACC AAAAAGTGCT TTGGCGAGGA GAACCTTTAC	6840
TTTTTCACCG TTGGCCAATT CGCTCATGTT TTGGTAGTGT AATTCTTCTG GAATGTTTAG	6900
GTTTTGAAGT AGTTGAGAGG CTTCACTCTC TGCTTCCCAA CCTCCAAGTT CGGCAAACCTC	6960
TCCTTCGAGT TCGGCAGCAC GAACCCGTC CTCGTCTGAG AAATCTTCCT TCATGTAGAT	7020
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GGCAGGTTCA TCTTCGTAGT CAAAGTGATT TTGACGAAGA ACAGAGAGAC GTTCATCTGG	7140
ACCAAGAGAG ATGTGACCAG TAGTAGGTTT GATATCTCCA GCTAAAATTT TAAAAAGGT	7200
TGATTTTCCG GCACCATTAG CACCGATTAA TCCGTAAGTA TTTCTTCTG TAAATTTGAT	7260
ATTGACATCA TCAAAAAGTT TGCGATCACT AAAACGTAGT GAAACATCAG ATACTGTAAG	7320

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CAATGTTTT CTCCTATATG TGTAATATAT TTATTCTACT AGAAAATACA GAAATATTCA	7380
AATTTTTATT TGTCAATTTT GTGTAAATTA TATTTACAGT ATCCTTTACA CAAATCTGTA	7440
AAAAGCAAGG CTGATTTATT TTGATAAATT ACGGTTATTT CATTAACAAA ATGCTATAAT	7500
TGAAAGGACT ATATCGAAGG AGAACAAAAT GACTAAACCC ATTATTTTAA CAGGAGACCG	7560
TCCAACAGGA AAATTGCATA TTGGACATTA TGTGGGAAGT CTCAAAAATC GAGTATTATT	7620
ACAGGAAGAG GATAAGTATG ATATGTTTGT GTTCTTGGCT GACCAACAAG CCTTGACAGA	7680
TCATGCCAAA GATCCTCAA CCATTGTAGA GTCTATCGGA AATGTGGCTT TGGATTATCT	7740
TGCAGTTGGA TTGGATCCAA ATAAGTCAAC TATTTTATT CAAAGCCAGA TTCCAGAGTT	7800
GGCTGAGTTG TCTATGTATT ATATGAATCT AGTTTCGTTA GCACGTTTGG AGCGAAATCC	7860
AACAGTCAAG ACAGAGATTT CTCAGAAAGG ATTTGGAGAA AGCATTCGA CAGGATTCTT	7920
GGTCTATCCA ATCGCTCAAG CAGCTGATAT CACAGCTTTC AAGGCTAATT ATGTTCTGT	7980
TGGGACAGAT CAGAAACCAA TGATTGAGCA AACTCGTGAA ATTGTTCTGT CTTTAAACAA	8040
TGCATATAAC TGTGATGCT TGGTAGAGCC GGAAGGTATT TATCCAGAAA ATGAGAGAGC	8100
AGGGCGTTTG CCTGGTTTAG ATGGAAATGC TAAATGTCT AAATCACTAA ATAATGGTAT	8160
TTATTTAGCT GATGATGCGG ATACTTTGCG TAAAAAGTA ATGAGTATGT ATACAGATCC	8220
AGATCATATC CGCGTTGAGG ATCCAGGTAA GATTGAGGGA AATATGGTTT TCCATTATCT	8280
AGATGTTTTT GGTGCTCCAG AAGATGCTCA AGAAATTGCT GATATGAAAG AACGTTATCA	8340
ACGAGGTGGT CTTGGTGATG TGAAGACCAA GCGTTATCTA CTTGAAATAT TAGAACGTGA	8400
ACTGGGTCCG G	8411

## (2) INFORMATION FOR SEQ ID NO: 17:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 9064 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO: 17:

TGCCGTACTC AAGTACAGCC TCGGCTAAGT TTCCTAGTTT GCTCTTTGAT TTTCATTGAG	60
TATTAGTAAC CAAAATCCGA CCACATAGCC AGCCCCTATG AATATAGCCA TTAAAGCTAG	120
CATGGAATTT AGGAAATPAA AAACCACCGC AGATACAAAG GTTAGCAGAA AAACATTAAA	180
AGCAATGGTG TCAGAAGCCA AGACTAGAAT ATAGGGTGTC AACCGATCTA AAGTTTGGGA	240
ATCTAGGAAA AATAAGTGT TATACATGAT GACCTCCTCT ATGGCTGAAA AGCAAGCCTT	300

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TTGTTTTTTT ACCCCAAGAC CCTATGTAGA AAAGTGAGCA AAAACGGGAA GGTCGCTACA	360
ATATTATTGA TCACATGCAC CGCATAGGAT GGATAAATGC TCTTGGTATA GCGGGTCAAA	420
CCAGCAAAGA TGATTCCAAC TGTGCAAAAG ACGAAGATAT CTAACAGACT AGGCAGGCTT	480
GAAAAATGAG GGAGAGCAAA TAAATAGAA GGAAGAAGCA AATCAAGACC AAATCGCGAA	540
TGCTTAAAGA AAGCATGTTG CAGTAATCCT CTATAAATCA ATTCTTCCAT CAGTGAACC	600
AGAAAGAACA GGGCTATATA AATACCTAGC TCTGCAAAGT TAGTCCCACT ATAACCAATC	660
AATACAGCCC AACCTTCCGC AGTTGACTGA ACATGTTTAG CTGTCTGAAC GTTAAAAGAG	720
ATCTGGAACA CTAGCACTAA TACTGTCAAA ATCGAATACC AAAGCCATTT TTTTCTTGGA	780
ATGCGGAAGA GATAACCATG GCCTGTCTTA ACAAGAACCA CAATCATGAC TCCAATAAAA	840
AGTAAACTCA AGATATTTTG AATCCAGAAT AAATTGCCTA TCTGAGAAGA AAATTGCCAA	900
TAGTTTTGGA CGATAAGCGT CAGCTGAGAA AGACTAAATA CGAAAAATAA GTAAGAGAAG	960
ACTGCACTTA TTTTGAATAG AAGTTGATAC TTTTTCATAG AAATCCTCCC TACTATGACC	1020
TCACCTTGTC AGGCTCTACT GCTGTAAGAT TAAGAAGACA GTTTGTTTTT TTTAAGGCTA	1080
ACCTGACTAC TAGATAATAG ATACATTAAG GCATTAAAGA CAATGAAAT ATGTCCATAG	1140
AATAAAATCA ACCTCGCATC CAAACCAAGA TAAAGTTGA TTATCAAAAA GATGAGCAAA	1200
AGAATTTGAA ACCATAAGGT TTTTCCAAAA ATAAATTTAA AGCGATTTTCG AATATCTACT	1260
TCCTTGATTT TTACCGCCAC CCCTTTATTA GCAAGAAGGA AAACCTCTGC TTCAACAAA	1320
CCACTGTAAA GAACAAGCCA CCCAATAGAT ACGATAGAGA TTTGTAAAAA TGTCCTTAAA	1380
AGAATATCCA ACACACTACT CAAGAAAATA ACAAAAAATA ATCTGTATTT CATATTAAAT	1440
ACCTCCATTC ATTTATTTCA CTAACAATTT AATAGAGCCT TCTACTCAA TATCCTGTCA	1500
GAAAAGGATA GAAAGCTACT TTTTATAATA CTTCAAGCCC CACATGAGCA GAAGCGTGAT	1560
AAACAAGCAG AGAATACACC TATATAAGCG ATTAGTTGTT GATAGAATTC TGTTCCTGAA	1620
ATACCTCTAT ACAAACAAAT GACAAACATA AAATCTGCCA AGCCGATAAA CATAAGTTGA	1680
TTGGTTCTAG GACTAACCAG ATCATCATTT ACTTATATTT AAGAGTATCT CTTTATTTTT	1740
AATGTATGTT AGCACTGAAA AGCAAGACAG GCCAATAATA TTAAAAATGA ACAGTAACGG	1800
GGTTAAGTCT CTAACAAAAAT TATCTACTGA CACTACAAGA AATACTATAC ATATTATAGT	1860
CGAAACTATC TTTTCTTAT CCATAATTAT TTAATCCTTT CTAACAAAT CCAGCTTATC	1920
AATCAAGAGC GATTTTAAAC ATAATGTAGC AGCACCCGTT GCAACTTTGA CAAGTTTAGT	1980
ATATCATGTG TTTTAAAAAT TTTTCATCCA AATCTTGAAT TGTCATCGAA ACATCTTGAA	2040

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TTGTTAAAAA ATTTAAAAAG TAAGCATTAA AACATACTT TCCTCTTTAT ATTGTATTGA	2100
TACCAACTTG TTTGTAGACT TTTCATCCTG CTATCACATA TCATTTTGAC AGGCGAAACA	2160
ATATTAAAGA AACTCCCCTG TAAATTAAGC TAGCAAATAC AGGGGAGAAA TTTATTTTTT	2220
AGAGAGTACT ATCCGTATCC TTTTGGGAAG ATTTTGAAAA TATTTTCTA ATTAAGTCAT	2280
CCATATAAGG ACCAAATATA CCAACTACTA AACCAATAAT AAAACTTTTA AAATCCATAA	2340
TTACCACCAA CATATTGCTG CATAGGCTAC ACCTCCAAGT ATAGCTCCAC CTGCAGCACC	2400
AGTTACACCT ATTCCTATAG CAAATGGTCC CAATAGAAAT GTCAAACCGT TGTGACACAC	2460
CCATCAATG CGCCATATGC AACCCCTGCT GCACAATAA TTTTCTTCC CCAATCAATA	2520
TCTCCACCTT CAACGCAAGC AAGCATTTCA TTATCCATAA CTGCAAATTG TGACATCATT	2580
TTTGTATCCA TATAGTGTAT CACTTTTCAG TTACGGAACA AGTTTAATAT AAAAATTATC	2640
AAAAAACAT AGGCAATAAA GAGAAAAAT AATTTATCAT AGATTAGAAA TAATATGACA	2700
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AGATAAATAA GATAGGTTG AAAAGCGAAG AGAATAATAA AGAATATAGC CTCATAAAA	2820
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CCAAATCCTC CTATGCGAGC GCCCCATGGT CCTAGAAGTC TCCCATATTT CACTCCACCC	2940
GCTGCAACAC CTAAAGCAGC AACTACAGCT GCTCCTCCGG AATTACCTCC ATAAACCTCA	3000
CTCAGCATTG TTTCATTTAT ATTACAATAA GTATTCATAC AAGTCTCCTT TTATTAAAT	3060
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CCACATGCTC CCATAAATGG TGCTCCAACA CCACTCGCAG CACAAATAGC TGTCCCTAGC	3180
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GTATCCATGA CAAATACTCT TTTTATTTT TAATTTTTGT CTTGTTGTAA CTTTGACAAG	3360
TTTAGTATAT CATCGTTTTT TAAATTTTT CATCCAGATT TTGAATAGTC ATCGAAACGT	3420
CTTGAATTGC AAAAATTACA TTAGACTTCC TGCAAACTA GAATCCTAGT TCATGATTGA	3480
TAATACCAGC ACTCAAATTC ATTCGTAATC CGAAGCGTTT ACGATGACTT CGATAGGTTG	3540
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TAGATAGCGC ATGGTTACAG GCTTTATCTT CAACTGTTAG CGGTTTGAGT TTGCTGGATT	3660
TACGTGAAGT TTGTGCTTGA GGATATATCT TCATGAGCCC TTGATAACCA CTGTCAGCCA	3720
AGATTTTACC AGCTTGTCGG ATATTTCTGC GACTCATTTT GAACAACCTC ATATCATGAC	3780
AATAGTTCAC AGTGATATCC AAAGAAACAA TTCTCCCTTG ACTTGTGACA ATCGCTTGAG	3840

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TCTTCATAGC GTGAAATTC TTTTACCAG AATCATTCGC TAATCTTTT TTTAGGGCGA	3900
TTGATTTTTA CTCCGTCGC ATCAATCATT ACCGTGTCCT CAGAACTGAG AGGAGTTCTT	3960
GAAATCGTAA CACCACTTTG AACAGAGTT ACTTCAACCC ATTGGCTCCG ACGAGTAAG	4020
TTGCTTTCGT GAACACCAA ATCAGCCGCA ATTTCTTCAT AAGTGGGTA TTCTCGCACA	4080
TATTGAAGAG TGGCCATAAG AAGGTCTTCT AGGCTTAAT TAGGTTTTCG TCCACCTTTT	4140
GCGTGTAA GTTGATAAGC TGTTTTAAAT ACAGCTAGCA TCTCTCAA AGTCGTGCGC	4200
TGAACACCAA CAAGACGCTT AAATCGTGCA TCAGTTAGTT GTTACTTGC TTCATAATTC	4260
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TTCTAACAAAT GTTTTAGAAG TAGAGGCGTA CTATTCTAGT TTCAATCTAC TATACTATAC	4380
CATATTTTGT TTCGCAGGA ATCTATTATA AAAGGTAAG TATTGCAAAA ACACTTACCC	4440
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AAGCATGATG ATTAAGCAGA GAACAGCGCC AATATAAGCG ATTATTTGTT GGTAGGATTC	4560
TCCTGCTGTG ATACCTCTAT ACAAACAAAT AATAGACATA AAACCTGTCA AGCCGATGAA	4620
CATAAGTTGA TTGGTTCTAG GACTAACCAA ATCATCATCT TCAAACTCTC TTATCCTCAT	4680
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AGTTTTCATT TCTTTCTCC TTTCTTTTGA TTGATAGCAA AATAGATCAT AACTGCAATC	4920
ACATAGGCTA TGGTATAAAA TAGCTGATAC CAAGCACTCT CCCTAAGCGG ATATAGAAAG	4980
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CCTAAATGTG CGATTATCT TAGTTGAGCA AGAACATTTA CACTGCTAGT ATAGCACTTA	5100
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TGTAGACTTT TCATCTGCT ATCAGATATC ATTTTGACAG GCGAAACAAT ATTAAAGAAA	5280
CTCCCTGTGA AATTAAGCTA GCAAATACAG GGGAGAAAT TATTTTTTAG AGAGTACTAT	5340
CCGTATCCTT TTTGGAAGAT TTTGAAAATA TTTTCTAAT TAAGTCATCC ATATAAGGAC	5400
CAAATATACC AACTACTAAA CCAATAATAA AACTTTTAAA ATCCATAATT ACCACCAACA	5460
TGTTGCTGCA TAGGCTACAC CTCCAAGTAT AGCTCCACCC GCAGCACCAG TTGCTGCACC	5520
TTGCCATGTT CCTGTTTTAA TGCCTAGTTG AAGACCTCTT GCTGCTCCTC CTCCAACACC	5580

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TGCTTTGGCA	AAATCTCCCC	AATTGCATCC	GCCACCTTCA	ACGCAAGCAA	GCATTTCACT	5640
ATCCATAACA	GAATAATTGTG	ACATCATTTT	TGTATCCATG	ACAAATACTC	CTTTTTTAAA	5700
AAACTAAAAT	AAATCAGAAT	AGAATCCTCA	TAATTTTACT	ATAAGTCTTA	CCAACCTAGT	5760
CCCAATTTAT	CACCAACCAT	ACCTCCTAAG	CATGTTAATC	CACCCCCAAT	TGCACCAATG	5820
TGTGCTCCAA	CAAATGCACC	AGCAAGTCCA	GCTACTCCTA	AAGTGGCCAA	ACCTGCTCCA	5880
GTTCCACCAG	TTATAATTCC	CGTAGTGACT	CCTGTAATCA	GTGCATTTTG	ACAATCAGTG	5940
GAGCTATACC	CCCCTTCAAC	TTTCGCAAGC	ATTTCACTAT	CCATAACCTC	TAAGTGTGAC	6000
AACATTTTTG	TATTCATGAT	GAATACCTCC	TTTTTATTTT	CAATTTGTGA	CCAAAGTCTT	6060
AAATTCATA	AACAAATAGA	TTTTTTATAG	TATCTTTTTG	ATTTCTTAA	AAAAGTATAT	6120
ACGTCTACTA	TCTTCTTAAA	GGTAGCAGTA	CCTATTTTTT	AGTCTAAGAT	TTCAATAATC	6180
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ATAATTAAAA	TTTTGCTAAC	TATCTTATTC	TCATCATCT	TAGATAACTT	TGATATTTTG	6420
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ATCTTACAAA	GAGGACATAA	TTCTGAACC	TACACAAATA	AGTGTGCTG	CTCCCCCAGT	6540
TATCGGACCA	GTCGACGAG	CTAATAGTAC	TGCTCCAATA	CAACCACCGA	TTGCAGATCC	6600
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AAATGGGCTT	TGAACAAGA	CCTGTTCAAG	CAGATAAAAC	GCTCTTTGAC	ATGAGTGATG	7200
TCCCCTATCC	ATTTATCGTT	CACGTTAACA	AAGAAGGAAA	ACTCCAACAT	TACTATGTTG	7260
TCTATCAAAC	AAAGAAAGAC	TATCTGATTA	TTGGTGATCC	TGACCTTCT	GTAAAAATCA	7320
CTAAATGTC	AAAAGAACGC	TTTTTCTATG	AATGGACTGG	AGTAGCTATT	TTTCTAGCTA	7380



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CCAAACCCAG CTATCAACCC CATAAGATA AAAAGAATGG TCTACTAAGC AAGCTTCCTT	7440
CCTCTGATTT TCAAACAAAA ATCTCTCATT GCTTACATTG TTCTCTCAAG CTTATTGGTC	7500
ACTATTATCA ATATAGGTGG TTCTTACTAT CTCCAAGGAA TCTTGGATGA ATACATTCCA	7560
AATCAGATGA AATCAACTTT AGGAATCATC TCAGTTGGTC TGGTTATCAC CTATATCCTC	7620
CAACAAGTCA TGAGCTTCTC CAGAGATTAT CTCCTAACCG TTCTGAGTCA GAGATTAAGT	7680
ATTGATGTGA TTTTATCCTA TATTGCCAT ATTTTGAAC TTCCCATGTC TTTCTTTGCG	7740
ACACGTCGTA CAGGAGAAAT CATTTACGA TTCACAGATG CTAACCTCTAT TATAGATGCC	7800
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GTCTTACTGG CACAAAACCC TAATCTCTTC CTTCTTCTC TTATTTCCAT TCCTATATAC	7920
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TCGCTCACGA GTGAAGAAAA TCGCTATCAA AATATAGACA GCGAATTTGT AGATTATTTG	8100
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GAAAAATATTA TCAACCTCCA AACCAAACTC CAATCTGCGA AGGTGCTAA TAACCGTTTG	8340
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CATATTAATT ACCTACCCCA ACAAGCCTAT ATCTTTAATG GCTCTATTTT GGAAAACTTA	8700
ACCTTGGGCG GTAATCATAT GATTAGTCAA GAAGATATTC TAAAAGCTTG TGAAGTAGCT	8760
GAAATCCGTC AAGACATTGA AAGAATGCCT ATGGGCTATC AAATCAGCT CTCTGATGGA	8820
GCTGGTCTAT CAGGAGGACA GAAGCAACGA ATCGCTCTCG CTCGTGCTCT TTAACTAAA	8880
TCTCCTGTTT TAATACTAGA TGAAGCTACT AGCGGTCTTG ATGTCTTGAC TGAGAAAAAG	8940
GTTATAGATA ATCTTATGTC TCTAACTGAT AAAACCATTC TCTTTGTAGC CCATCGTCTC	9000
AGTATAGCCG AACGAACCAA CCGTGTCAAT GTTCTTGACC AGGGGAAAAAT CATGAAGTT	9060
GGTA	9064

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## (2) INFORMATION FOR SEQ ID NO: 18:

- (i) SEQUENCE CHARACTERISTICS:  
(A) LENGTH: 7780 base pairs  
(B) TYPE: nucleic acid  
(C) STRANDEDNESS: double  
(D) TOPOLOGY: linear

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO: 18:

CTCCATTTT	TTGATTTCAT	AAATAAACAA	CCTCTCTGTT	AATTTTGTAT	AATTATAACG	60
ATATCCAAGT	TACTTGTCAA	GTGTTTITTA	AATTTTATC	TCAAAAATAT	TTTTTCGTTT	120
AAAAAAGGA	GCCATCAGTT	GATTTCAGC	TCCCTTTTAT	ACAGAATTAA	ACTATTTTAT	180
AGTTCGACAA	TCTTACCTGT	TTCAAAGTAG	ACAACCCATT	CACAGATATT	TTTAGCATAG	240
TCACCGATAC	GCTCCAAGTA	GGAAATAACT	TGGAATAAT	CACGACCCGT	AACAATGGCT	300
TCTGGATTTT	TCTTAATCTC	TTCAGTCGCA	AGGTCACGGA	TAGTTTCAAA	ATAGTGGTTA	360
ATTTGCTCAT	CCATGGAGGC	CACCCGGTAT	CGGTCGTCAA	CAGAACCATT	AAGATAAAGA	420
TCAAGTGCTG	CTTCCACAAC	GCTTTTAACT	TCACGTCCCA	TTTTTTTAA	TTCTTCCTCT	480
ACAGCTGGAA	TGCGCTCTTC	CCCCTTCATA	CGGATGGTTG	CCTGGGCAAT	GGCTACAGCG	540
TGATCCCCCA	TACGCTCCAC	ATCTGATACA	GCCTTAAGGA	CAGTCAAGAC	TGTACGCAAA	600
TCTTGAGAGA	CTGGTTGTTG	GAGTGCGATC	ATTTCAAATG	ATTTCTTTTC	CAGTTTCACT	660
TGCTATTCAT	TTACTTCTGC	ATCATCTTCG	ATGACCTCTT	TTGCCAGGTC	ACGGTCATGC	720
GTGACAAAAG	CACGTACCGT	ACGATTGATT	TGTGAGAGCA	CTTCTTGTC	CATAGCGTAG	780
AACTGGTTAT	GTAATTTCTC	TAAATCTTCT	TCAAATGAG	ATCGTAACAT	CTTTCATCTC	840
CTTATCCAAA	TTTTCTCTGA	ATATAGTCTT	CCGTTTCCTT	GTGTTGGGGA	TCAAGGAACA	900
TCTGCTTGGT	ATCATTAAAT	TCAATCAAAT	CTCCATCTAG	GAAAAATCCT	GTCTTATCAG	960
AGATACGTGA	AGCTTGCTGC	ATGGAACGGG	TTACCAGAAG	CATGGTGATC	TTGTCTTTTA	1020
GACCATACAA	GGTTTCCTCA	ATTTTACCAG	CTGAAATCGG	ATCCAAAGCC	GAAGTTGGCT	1080
CATCCAAGAG	GATGATTTTA	GGACTAGTTG	CCAAGACACG	GGCCACGCAG	ACACGCTGCT	1140
GTTGACCACC	TGACAAATCCA	ATAGCTGAAT	CATATAGACG	ATCCTTGACC	TCATCCCAGA	1200
TAGAGGCACC	TTGCAAGGCT	TTTTCTACGG	CTTCATCCAG	AACCTGCTTA	TCCTTAATTC	1260
CATTGATACG	AAGCCCGTAG	ACAACATTCT	CATAGATAGT	CATAGGGAAA	GGATTAGGTT	1320
GTTGGAAAAC	CATTCCGATT	TCCTTACGTA	ATTCAACCGT	ATCTGTACGC	GGACTGTAGA	1380
TGTTGTGACC	ATTGTACACC	ACGGATCCAG	TGTGGTCCAC	CTCTGGATTG	AGATCTCCCA	1440

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TGCGGTTGAG AGACTTGAGG AGGGTTGACT TCCCTGATCC AGATGGACCA ATCAAGGCTG	1500
TAATTTCCCTT AGGTTGGAAA GATAGGGAAA CACTATTCAA AGCCTTCTTT TTATTATAAT	1560
AAACGGACAG GTCTGATACC TGTAAATCG CATCTGTCAT ACGGTTTCCT TTCTAACCAA	1620
AGTGACCAGA TACATAGTCA TTGGTGGACT GTAGCTTGGC ATTTTGGAAA ATAGTTGCAG	1680
TCTTGTCATA CTCAATCAAA TCACCCAAGT AAAAGAAGCC TGTATAGTCA CTGACACGAG	1740
CAGCCTGCTG CATATTATGC GTTACAATGA TGATGGTAAA GTTTTTCTTG AGCTCAAACA	1800
TGCTCTCTTC TAGTTGCATG GTCGCAATCG GATCCAAGGC TGAGGCTGGC TCATCCATTA	1860
AGAGGATATC TGGCTTAACA GAGATGGCAC GAGCGATACA GAGACGTTGT TGCTGACCAC	1920
CTGATAAGGT CAAGGCTGAC TTGTGGAGAT CGTCTTTAAC CTGATCCCAG AGGGCAGCCT	1980
GACGAAGGGA GGTTCCTACG ATTTTCATCTA GGACTTGCTT ATCCTTAACT CCAGCACGTT	2040
CATGCGCAAA GGTAAATATTA CGGTAAATTG ACTTAGCAAA TGGATTGGGA CGTTGAAAAA	2100
CCATTCCAAT GTGTTTACGC ATTTCATAAA CGTTGATTTC TGGACGGTTG ACATCAATTC	2160
CACGATAGAG AATCTGCCCA GTTACTTTAG CAATATCAAT AGTATCATTG ATGCGATTGA	2220
GACTGCGTAA GTAGGTAGAT TTCCCGATC CCGACGGGCC AATCAAAGCT GTAATTTTAT	2280
TTCTTTCAAA TTGCATATCA ATCCCCTTAA TGGATTCAAT TTTACCATAG TAAACATGGA	2340
CATCCTTAGT AGAAAGGGCT ACTTTTCTT CAGGAAAGGT AAGGATATGC TTCTCATCCC	2400
AGTTATATGT TGACATGGCT TCTCCTTTAG GCAGCGGTTA ATTTCTTTGTG TAGATAGCTT	2460
CCGAACCTAC GAGCTCCAAA GTTAAAAATC AGGATAAAGA TCAGGAGCAC AGCGGCAGAA	2520
CCTGCTGATA CAATGGTTCC ATCTGGAATA GTGCCCTTAC TATTGACTTT CCAGATATGG	2580
ACAGCCAAGG TTTCTGCTTG ACGGAAGATA GAGATGGGC TAGTCACACT GAGGATATTC	2640
CAGTTAGACC AGTCAAGAGC TGGCGCCGAT TGCCCTGCTG TATAGATCAG AGCTGCAGCT	2700
TCGCCAAAGA TACGACCAGA TGCCAAGACG ACACCCGTTA CAATACCTGG AAGCGCTTCC	2760
GGAATAACAA CATGAACCAC TGTCTCCAG CGAGAAATCC CAAGAGCCAG ACCAGCCTCA	2820
CGTTGGGTAT GGTGAACGTG TTTCAAATA TCCTCTACAT TACGCGTCAT CTGAGGCAAG	2880
TTAAAGACTG TCAAGGCCAA GGCACCTGAA ATGATTGAAA ATCCATACTC AAACTGGACT	2940
ACAAAGATCA AGTAACCAA GAGACCCACC ACCACTGATG GTAAAGAGGA CAAATTTCA	3000
ATACAAGTCC GCACAAAGTT GGTAACAGGA CCTTTTTTAG CATATTCAGC CAAGTAAATC	3060
CCAGCTCCCA TAGAAAGAGG TACAGAAATA ATCAAGGTAA TGACCAATAG GAAAAAGGAA	3120
TTGTAAAGCT GAATGCCAAT CCCACCACCT GCTTGAAAAG CAGAAGACCT TCCAGTCAAG	3180

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AAAGACCAAG AGATATGGGG CAAGCCCCGA ACCAAGATAT AGAGAATCAA GGAAGCCAAG	3240
ATTGTCACAA TGATGCTAGC AATCGTATAG AGGACAGCTG TTGCAAGTTT ATCTAATTTC	3300
TTAGCGCGCA TAATTTTTCT TTCCTCTTTC TTTCGTAATC AATTTAATCA CACTGTAAAA	3360
AACTAAGCTC ATCAAGAGCA GTACCAAGGC CAGTGACCAG AGAACATTAT TATTTACAGT	3420
TCCCATGACA GTGTTCCCAA TTCCCATAGT TAATATAGAA GTTAAAGTTG CAGCTGGTGT	3480
GGTCAAGGAA GTTGGGATAA CAGCTGAGTT TCCGACAACC ATCTGGATAG CTAGAGCCTC	3540
ACCAAAGGCA CGCGCCATCC CAAAGACCAC TGCAGTGAAA ATACCAGAAC GGGCCGCCTT	3600
CAAGATCACA CGCCAGATAG TCTGCCAGCG AGTGGCTCCC ATAGCGAAAC TGGCTTCACG	3660
ATAATAACGA GGAACCGCAC GCAAGCTATC CGTTGTCATA AAGGTTACGG TCGGCAAAAT	3720
CATGACAAAG AGGACGGAAA TCCCTGACAA AATCCCAAAA CCAGTCCCAC CAAAGACACT	3780
GCGAACAAAG GGAACGACGA CTTGCAAGCC AATAAATCCG TACACTACTG AAGGAATCCC	3840
AACCAGGAGT TCAATAGCTG GTTGCAAAAT CTTGCCCCCT TTTGGTGATA CTTGCGTCAT	3900
AAAACTGCT GCACCAATAG CAAAGGGTGT TCGGATAAGG GCTGAGAGAA TGGTAACGAT	3960
AAAGGAACCC AAAATCATAG GAAGGGCACC AAATTCTTTA CTAGAAGGAT TCCAAGTTCC	4020
TCCCAAAAGA AAGTCAAAGA TATTACACCC ATTGACAAAG AAGGTCGACA AGCCTTTTTG	4080
CGCTACGAAA ACCAAAATCA TGGCCACAAG GATGACTATC AAAGAAAGAC AGGCAAAGT	4140
CAAACCTTTT CCTAATTTCT CCAGACGAGA ATTCTTTGAT GGAAGCAACA TTTTCTTAGC	4200
TAATTCTTCT TGATTCAITTA TTGTCTCCCT TCCAACACTG TCACAGTTCC GGCAGCATCT	4260
TTTTCAACCT TCATTTCTT AATCGGAATA TACTTCAATC CTTTGACAAT CCCTTCTTGG	4320
GTCTCATCCG AGAGAACAAA ATTGAGAAAT TCTGCAGCCA ACTCATTTGGG CTGCCCCAAT	4380
GTATACATAT GCTCATAAGA CCACAAGGGC CAATTATTGC TACTTATATT TTCTGGACTT	4440
AAGTCATAGC CATTCAACTT CATGCTTTTG ACCGAATCAT CTATATAGGT AAGAGATAAA	4500
TAAGAGATAG CTCCTGGACT TTTTGATACG ATTGATTTTA CCGCTCCATT TGAATCCTGC	4560
TCCTGACTTT GCATGGCAGA CTGACCTTCC ATAATGACAG TATCAAAGGT AGCAGGAGAG	4620
CCAGAGCCCG CTGCCCCGATT GATAACAGAG ATGGGTAAGT CCTTACCACC AACCTCTTTC	4680
CAATTGGTTA CCTCACCTAT GAAGATTGTA CGAAGTTGCT CTGTCGTTAG GTTATCAACA	4740
TCAACCTCCT TATTGACAAT CAGAGCCAAG CCAGCTACCG CGACCTTGTG GTCAACAAGA	4800
GCAGAAGCAT CAATTCCTGC TTTTTCCTCA GCAAATACAT CTGAGTTTCC TATATCAACT	4860
GGCCAGACT GAACCTGGGA CAAGCCTGTA CCAGAACCTC CCCCTTGGAC ATTGACCGTT	4920
TTTCCAACAT GGATCGTGCC AAATTCATCT GCCGCTACTT CAACCAAGGG TTGCAAGGCA	4980

GTTGAGCCAA CAGCCGTTAT GGATTCTCCA CGATCAATCC AGCTAGCACA GCCTACTAAA	5040
CAAGCCGTCA GCCAAAAAGC GATAAGAGAC AGAGCAAGCT TTTTCTTTT TTTACTGTT	5100
TTTCTCCTCG AAAATAATTA TGAATACTGT GAATTTTTTA AGTAGTTCTT TATGAGTTGA	5160
CGCATGAATT CTTACCAAAT TTCTGCGCAA TTGATTATTT ATATAATATA GGCTATATTA	5220
CTCTTTCCTA ACCTCCTTTT TTCATATGTG GATAAAATCT CTGTCTATC CCTTCCCCA	5280
TTGTCAACCA TTATAGTCAT TTCGTGTCTC TTTTCCCCT TTTTAATGCA AGGGAAATTA	5340
CTCTCCTTAG ATGATAATCC AAAAGCTAGA AAGGTATCTC AAACCTCTCT ACTCTCCCAG	5400
ACTAGTTTAC AACTAAAAGG AAAAGATTCT ATTTTATGAG AAATCTAGTT TACAAGCGGT	5460
AAGAACGCTA ATAACATAAC TTCTTGTAAT CTTTGAAAAT CTCTCAAAC CAGTGTTTTG	5520
AGCTATCTAT GGCTAGCTTC CTAGTTTGCT CTTTGATTTT CATTGAGTAG TAAAACTACA	5580
TGTAATGGCA ATCAAGATAT CAAGAATCAT CCTACTAAA AAATCCATAC TTTACTATA	5640
ACATAGAATA AGATATTTGA CTAGCATTTT CATTGAATC TGAGGCCTTT TGGAAAATAA	5700
TTTTTCAAAA CATTTCCAGT AACCTTTGCA AAGCCCAAGC CATTGCCTTT AACCAAACT	5760
TGGTACCAAC CATTTGGCAG ACTTTCTGCC AGCTGAACGG TTTCTCCAGC CGCATACTTG	5820
ACAAACGCTT CTGGGCAAT TTCAACCGAC TGTTCGACCT GACTCGGTTT CAAGGCTAAA	5880
CCAAGAGCGA AACTGGGCTC AAAGCGTTTC TTCTTAAAAG TACCCAGATG CAGTCCATTG	5940
CGAGCAATCT TGAGCTTCCA TAAATCTGGC AAAAGTTCTG GCAAGAGATA AAGCTGGTCT	6000
CCAAAAATCT GCAAGATACC CGGTAGATTG ACCTTCAAAT GGTTTTGGGC AAATTCCTGC	6060
CACAAGGCAA CTTGTTACAG GCTGAGGTTA CTCTTACTTG CCTTAAATTT AGGAGCTGGA	6120
TTGTTACCTT TAAACTGTAG ATGGGCAACA AACTGACCCT CTCCCTTAAA CTGATGAGGA	6180
TACATCCGAG CCGTTTCTGG CAGGTCAATA CCAGCTACCA TTCCATTGAT ATGCTCTACT	6240
GGCAACAAGT CAAAATCATA CTCTCCAGC AACCAATTGA CAATCTCTTC GTTTTCCTCG	6300
GGTGCCGAG TACAGGTCGA ATAAACCAGA TGACCACCTT CAGCTAACAT GGTCAGTGA	6360
TCCTCCAGAA TTTCTCTTTG CAAGCTAGCA CATTGACTCG GATAATCTAA GCTCCAATAG	6420
TCCATAGCAT CAGGTTGCTT ACGAAACATT CCTTCACCAG AGCAAGGGGC ATCAAGAACG	6480
ATTAAGTCAA AATAGCCTTT AAAGACCTTG ACCAAGCGGT CGGCAGATTC ATTGGTCACC	6540
ACGACATTTG TCGCTCCAAA ACGCTCCATG TTTTCAACCA AAATCTTAGC CCGTTTGCTT	6600
GAAATTTTAT TGGAAACAAG TAGCCCTCC CCTGCTAGAT AGGCTGCCAG TTGAGTTGAT	6660
TTGCCCCCG GTGCAGCAGC CAAGTCCAAG ACCTTCATAC CAGGACTGGG TTGGGCTACT	6720

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TGAGCCACCA TTTGAGCAGC AGGTTCTTGC GAATAAACTA AACCTGTAGC ATGCTCAGGC	6780
GATTTCCCTG AAACCTTCCC ATAGTGGCCC CAAGGGGTTT GAGTAATGGC ATCAGAAAAG	6840
GAAAGTTGCT CTTCTTTTAA GGGATTGACC CGAAAGGCCG AAACCGCTTC CTCCTCAAAA	6900
GAGGCAAGAA AATCTCTTGC CTCATCTCCT AGTATCTCTT TATATTTTTC AACAAATCCT	6960
TCTGGAAATT GCATTTAAGT TCTTTTCCTT TCGTAAATAT AGGACTGAAT TTCCTCCTGC	7020
ATCTCAAGAG GCACCATCAT GACCGGCTGT CTGGTTTGAA AATCAGGAGC TTCACCAAAA	7080
AGGGTCACAA CCCGATAGCC CAGACTTTCC CCTAAAATAC TAGCTGCGGC ATAATCCCAT	7140
GGTTGCAGAT AAGTGAGATA GGTCAACAAA CGCCCTGACA AAATCTTGGC AAAACTAATG	7200
GCCGCACTTC CATAGACACG AACACCAAGA ACCGCTCGGC TCAAATCAGC CAGCCCCCAT	7260
TCATTGGTTT CCAGCATACC ACTATTCCTT GCAATGAGAA AATCTCCAAG TGGTTTAGTT	7320
TTAAAAGGAG CTAGGGACCT ATCATTTAGA CAAACTGGAA ATTCCCCACC ACCGTGGTAA	7380
CAATCCCCTT TGACCACATC ATAAATCAGA CCAAACTGTC CCTGACCATT TTCAAAATAA	7440
GCCATCATAA CAGCAAAATC TTCCTGCTGG GCTACAAAAT TATTGGTACC ATCAATGGGA	7500
TCAATGACCC AAACCTTGCC CTCTTGAACC GAGGCTCGCA GACAACCTTC TTCAGCACAA	7560
ATCTTATCCT CAGGATAACG GGACAAAATC TCACCAACCA AGAGTTCCTG AACTTCTTTG	7620
TCCAGTCTGG TCACCAAAATC TGTGGAGAG GACTTGGTTT CAACACGCAA GTCTTCCTGC	7680
ATATGGTCAA GAATGTACTG ACCTGCTTTC TTAACAAGCT CTTTAGCAAA TTCAAATTTA	7740
CTTTCCAAGA GAAATCTTTC CTTCCCCTTT TTCTTTGGGG	7780

(2) INFORMATION FOR SEQ ID NO: 19:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 4820 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 19:

GTAATGATAT AGGAACACCA GGTGACCTGA TGGGACGTGC TAAGCCTATG AACTACTAGC	60
TGCTAAAGGC TTAAAGATG GTATGGTACC ATATATCTCA AACCAATACG AAGAAGAAGC	120
CAAACAAAAG GGCAAGACAA TCAATCTCTA CGGTAAAACA AGAGTTTGG TTACAGATGA	180
CTTGGTTTGG GAAAAGGTAT TTAATAACCA ATATCATACT TGGAGTGAGT TTAAGAAAGC	240
TATGTATCAA GAACGACAAG ATCAGTTTGA TAGATTGAAC AAAGTTACTT TTAATGATAC	300
AACACAGCCT TGGCAAACAT TTGCCAAGAA AACTACAAGC AGTGTAGATG AATTACAGAA	360

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ATTAAATGGAC GTTGCTGTTC GTAAGGATGC AGAACACAAT TACTACCATT GGAATAACTA	420
CAATCCAGAC ATAGATAGTG AAGTCCACAA GCTCAAGAGA GCAATCTTTA AAGCCTATCT	480
TGACCAACAA AATGATTTTA GAAGTTCAAT TTTTGAGAAT AAAAAATAGT GTCTACTATT	540
AGGAAATAAA GTTTAAAAAG GTGATGAAGA ACAAACCAAG ATTCAAGCAG GAATTCCTAC	600
TGATAATGAA GTAAGTTATG ATCTTATTTA TCAGCAGGAA ACTCTTCCTG CAACAGGTTT	660
ATCAACTTCT GAGCTTACAG CTTTAGGCCT ATTAGCTGTT GGTAGTTTAG TTCTTTTGGT	720
TCATAATATG ACGGGAACAG TTTTGTGCTC CCTCTGAAAA GTCATCATTT GATGGCTTTT	780
TTCTATATAG GGTAAAGAT AGGGTAAAAG GCTATCATCG GACAAAATAA AGAAGGCATG	840
ATATAATATA AAGTAGATTT CTATGTCATA AAACAAGAAC TGTTTGGACA TCATTCAATT	900
GAAACTCTC TATGTTCAAA CAATAGTAAA ATAAATAGG GGATCTAAAT CCTTGCTATG	960
AAAGGAAAAA ACTCAATGGC TACTATTCAA TGGTTTCCTG GTCACATGTC TAAAGCTCGT	1020
CGACAGGTGC AGGAGAATTT AAAATTGTT GATTTGTGA CGATTTTAGT AGATGCACGC	1080
TTGCCCTCTAT CTAGTCAAAA TCCTATGTTG ACCAAGATTG TTGGTGATAA ACCAAAACTC	1140
TTGATTTTAA ACAAGGCCGA CTTGGCTGAT CCAGCAATGA CCAAGGAATG GCGTCAGTAT	1200
TTTGAATCAC AAGGAATCCA GACGCTAGCT ATCAACTCCA AAGAGCAAGT GACTGTAAAA	1260
GTTGTAACAG ATGCGGCCAA GAAGCTCATG GCTGATAAGA TTGCTCGCCA GAAAGAACGT	1320
GGGATTTCAGA TTGAAACCTT GCGTACTATG ATTATCGGGA TTCCAAACGC TGGTAAATCA	1380
ACTCTGATGA ACCGTTTGGC TGGTAAAAAG ATTGCTGTTG TTGGAAACAA GCCAGGGGTC	1440
ACAAAAGGTC AACAATGGCT TAAAACCAAT AAAGACCTGG AAATCTTGA TACACCGGGG	1500
ATTCTCTGCG CTAAGTTTGA GGATGAAACT GTTGCACTTA AGTTGGCATT GACTGGAGCT	1560
ATCAAAGACC AGTTGCTTCC TATGGATGAG GTTACCATTT TTGGTATCAA TTATTTCAAA	1620
GAACATTATC CAGAAAAGCT GGCTGAACGC TTCAAACAAA TGAAAATTGA AGAAGAAGCG	1680
CCTGTGATTA TTATGGATAT GACCCGCGCC CTCGGTTTCC GTGATGACTA TGACCGTTT	1740
TACAGTCTCT TCGTGAAGGA AGTCCGTGAT GGCAAACCTG GTAACATATC CTTAGATACA	1800
TTGGAAGACC TCGATGGCAA CGATTAAAGA AATCAAAGAA TTCCTTGTGA CAGTCAAGGA	1860
GTTAGAAAGC CCTATTTTTT TAGAGCTTGA AAAGGATAAT CGCTCAGGAG TTCAAAGGA	1920
AATCAGCAAG CGTAAAAGAG CCATTCAAGC TGAATTAGAT GAAAATTTGC GCTTGAATC	1980
CATGCTTTCT TATGAAAAAG AACTTTATAA GCAAGGATTG ACCTTAATTG CAGGTATTGA	2040
TGAGGTTGGT CGTGGTCCTC TTGCTGGTCC TGTAGTCGCT GCGGCCGTTA TTTTATCTAA	2100

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AAATTGTAAG ATTAAAGGTC TCAACGACAG CAAGAAAATT CCTAAAAAGA AACATCTGGA	2160
GATTTTCCAA GCCGTTCAAG ACCAAGCCTT GTCGATTGGA ATTGGTATCA TAGATAATCA	2220
GGTCATCGAC CAAGTCAACA TCTATGAAGC AACCAAACTA GCCATGCAAG AAGCAATCTC	2280
CCAGCTCAGC CCTCAACCAG AGCACCTTTT GATTGATGCC ATGAAACTGG ACTTGCCCAT	2340
TTCAACAAACC TCCATTATCA AAGGAGATGC CAACTCCCTC TCTATCGCAG CAGCATCTAT	2400
AGTAGCCAAG GTAACACGTG ATGAATTGCT GAAAGAATAC GATCAGCAGT TCCCTGGCTA	2460
TGATTTGCGT ACTAATGCAG GATATGGCAC AGCTAAACAT CTGGAAGGCC TCACAAAAC	2520
AGGAGTTACC CCAATTCACC GAACCAGCTT TGAACCCGTT AAATCACTGG TTTTAGGTAA	2580
AAAAGAAAGT TAATTGAAAG GAAATAACAT GGAGGAACAG TCGGAAATAG TCCGTTCTAA	2640
GAAAGAATTC GCCTTTGCAT CCAGCACTAT ACTATCCCAA GTTGGTCGAG GAATCATTTG	2700
CGGCCTCATC GTTGAATTA TCGTCGGATC CTTTCGTTTC TTAATTGAAA AGGGCTTCCA	2760
CCTGATACAA GGAGTTTATC AAGATCAAGG GTACTTAGTG CGCAATCTTT TTGTACTGGT	2820
TTTGTTTTAT ATACTCATCT GTTGGCTCAG TGCCAACTA ACACGGTCAG AAAAGATAT	2880
TAAAGGCTCA GGAATTCCTC AAGTCGAAGC CGAACTGAAA GGCCCTCATGT CCCTCAACTG	2940
GTGGGGCATT CTTTGAAAAA AATATGTGCT AGGTATTCTT GCTATTGCCA GTGGACTCAT	3000
GCTGGGTCGA GAGGGACCCA GCATTCAACT TGGAGCAGTT GGTGGTAAAG GAATTGCCAA	3060
GTGGCTCAAA TCCAGTCCAG TAGAGGAACG TTCCTTGATT GCCAGTGGAG CTGCAGCAGG	3120
TTTAGCCGCA GCCTTTAATG CTCCTATTGC AGCACTTCTC TTTGTTGTAG AAGAAGCTA	3180
TCACCATTTT TCGCGCTTTT TCTGGGTCTC AACTCTAGCA GCCAGCATCG TAGCAAAC	3240
TGTGTCTCTA CTCATGTTCTG GTTTGACACC AGTATTGGAT ATGCCAGATA ACATTCTCTC	3300
CATGACCCTA GATCAGTATT GGATATATCT CGTCATGGGA ATTTTCCTTG GATTTTCAGG	3360
TTTTCTCTAT GAGAAAGCTG TATTAAACGT TGAAGAGTT TATGACTTGA TTGGTCAAAA	3420
AATCCATTG GATAGGGCTT ATTATCCCAT CTGGCTTTT ATCCTTATCA TACCAGTCGG	3480
AATCTTCTTA CCTCAAATCA TTGGTGGCGG AAATCAGCTT GTCCCTTCTT TAACTGAACA	3540
AAATTTTAGT TTCCAAGTTT TATTAGCTTA CTTTTAATC CGCTTTATTT GGAGTATGAT	3600
TAGCTATGGA AGTGGACTGC CAGGAGGAAT TTCTCTCCCC ATTTTAGCTC TTGGTTCTTT	3660
GCTTGGTGCC TTAGTTGGTG TTATCTGTGT CAATCTTGA CTGTGTCAGTC AAGAGCAATT	3720
CCCTATATTT GTCATTCTAG GAATGAGTGG CTATTTTGA GCCATATCAA AAGCTCCCTT	3780
AACCGCTATG ATCCTCGTAA CTGAGATGGT AGGAGATATT CGCAACCTTA TGCCACTTGG	3840
TCTTGCTACT CTTGTTTCTT ATATTATCAT GGATTTGCTC AAAGGTACGC CAGTCTATGA	3900



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AGCCATGCTG GAAAAAATGC TTCCAGAAGA AGTATCTAGC GAAGGAGAAG TTACACTTAT	3960
CGAAATACCA GTTCTGATA AAATTGCTGG GAAACAAGTT CATGAACTCA ACTTACCACA	4020
CAACGTCCTC ATCACAACTC AAGTCCATAA TGGCAAGAGC CAAACAGTTA ACGGCTCAAC	4080
CAGAAATGTAT CTGGGTGATA TGATTCACCT GGTATTCCA AAAAGTGAAA TTGGAAAAGT	4140
CAAAGATTG TTGTTGTAGT ATGAGTATTT ACATAATTTA TGTATGTAA ATGATCAGTT	4200
TGATTTATTT AGAAAACCGA TTCTCAGGAA TGAGATCGGT TATTTTAC TGATGAGGAA	4260
TTTTACATAT AAATAATTGA ACTTTATTAA AAATAAGACT ATAATTAAGT TAGAAATGAT	4320
AAAGTATAAA GCTAGAAAGG AGTTTACTGT ATCAAATCTG TACAGTAAGA TTAATCAT	4380
GAAAAAGAAA ACAATAGCAA TTATATAGAG AAATGAAATA GAAATAGGAT AAAACAATCA	4440
GGACAATCAA ATCAATTTCT AGCAATGTTT TAGAAGTCCA GATGTACTAT TCTAGTTTCA	4500
ATCTATTATA CAATGTGTTT TGTATCTCAT AGCTCCTTAT ATAGCTCTTC AGTTATGTAG	4560
TATTAACAGA AGTTTAGTGG GTGAGATTTT TATTATTTT CTTATTCTGT TTTGTTGTA	4620
GGTCTAAGTC TTTTATCAC TTGAAAAAC TCCTATAACA TCTTTCCGAA AAATATAAT	4680
TTTCTTGAAA AATATACAAG TCTATGCTAT ACTACTAGTA TACTTACTTA TGGAGAAAAT	4740
ACATGAAACG TGAGATTTTA CTGGAACGAA TCGACAAACT AAAACAATC ATGCCCTGGT	4800
AAGTTCTGGA ATACTACCAA	4820

(2) INFORMATION FOR SEQ ID NO: 20:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 21338 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 20:

CTACGACATC ATGATTAACA GTCATGCGCT ACTACCAACT GAGCTATGGC GGATAAAATA	60
GTCCGTACGG GATTCGAACC CGTGTACCG CCGTGAAAG GCGGTGCTT AACCCCTTGA	120
CCAACGGACC TTCTATCTGT AGCAGATATA ACCATTATAT CAATTTCTTG CTAATTGTCA	180
ATCACTTTTG AGATTTTTC TCTAAATAT CTTTAATTT TCTAATTTT AATCTTGAAA	240
TAGGACAACG ATGGTCTTCA TAGAAAACAA TTTCTAAGTT TTTTCGATCA ATTTCTCTGA	300
TATTACCTAT ATTTACCAAA AATGACTTGT GAGGAGAATA AAATCGCTGA GTATGTTTGT	360
CCTTTTCTCG AATATCTGTC ATGGTACCAT AAAACTCTTT TGCAAAATTC TTACCAATAA	420

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TGCGCAATTT ATGAGATACC CCTGTTGTTT CAATATACAA AATATCATGG TAAGGAATTT	480
TTAAATCATT TCCCTTGTA TGTAGTCGA AATAATCTAC AACATCTTCA TTTTCAAGTA	540
ACATACTCTT CGTGTAGAAG ATATTTTGCT CAATTCTCTT CTTAAACATC TCATCATTGA	600
TATCCTTATC AACAAAATCT AGGGCTGATA CCTGGTATTT ATAGGTTAGA GTCGAAACT	660
CTGATCGACT AGTGATAAAG ACGATAATAG CGTAAGGATT GTAATGACGA ATGAGCTGAG	720
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TAAAAATCAA TTATTGCGTT TACAAGAAGA AAAGGAAAGG AAGAATGCGT AAATTCCTTAA	14640
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TCGTCTATAC TTCGAAAGAA ATTTATTACC TTTCACAATC TGACTTTGGT ATTTATTTTA	14760
GAGAAAAATT AAGTTCCTCC ATGGTTTATG GAGAGGTTCC TGTATTATGCG AATGAAGATT	14820
TAGTAGTGGG ATCTGGGAAA TTGACTCCCA AAACAAGTTT TCAAATAACC GAGTGGCGCT	14880
TAAATAAACA AGGAATTCCA GTATTTAAGC TATCAAATCA TCAATTTATA GCTGCGGACA	14940
AACGATTTTT ATATGATCAA TCAGAGGTAA CTCCAACAAT AAAAAAGTA TGGTTAGAAT	15000
CTGACTTTAA ACTGTACAAT AGTCCTTATG ATTTAAAAGA AGTGAAATCA TCCTTATCAG	15060
CTTATTCGCA AGTATCAATC GACAAGACCA TGTTTGTTAGA AGGAAGAGAA TTTCTACATA	15120
TTGATCAGGC TGGATGGGTA GCTAAAGAAT CAACTTCTGA AGAAGATAAT CGGATGAGTA	15180
AAGTTCAAGA AATGTTATCT GAAAAATATC AGAAAGATTC TTTCTCTATT TATGTTAAGC	15240
AACTGACTAC TGGAAAAGAA GCTGGTATCA ATCAAGATGA AAAGATGTAT GCAGCCAGCG	15300
TTTTGAACT CTCTTATCTC TATTATACGC AAGAAAAAAT AAATGAGGGT CTTTATCAGT	15360
TAGATACGAC TGTAATAATC GTATCTGCAG TCAATGATTT TCCAGGTTCT TATAAACGAG	15420
AGGGAAGTGG TAGTCTTCCT AAAAAAGAAG ATAATAAAGA ATATTCTTTA AAGGATTTAA	15480
TTACGAAAGT ATCAAAGAA TCTGATAATG TAGCTCATAA TCTATTGGGA TATTACATTT	15540
CAAACCAATC TGATGCCACA TTCAAATCCA AGATGTCTGC CATTATGGGA GATGATTGGG	15600
ATCCAAAAGA AAAATTGATT TCTTCTAAGA TGGCCGGGAA GTTTATGGAA GCTATTTATA	15660
ATCAAATGG ATTTGTGCTA GAGTCTTTGA CTAAAACAGA TTTTGATAGT CAGCGAATTG	15720
CCAAAGGTGT TTCTGTTAAA GTAGCTCATA AAATTGGAGA TGCGGATGAA TTTAAGCATG	15780
ATACGGGTGT TGTCTATGCA GATTCTCCAT TTATTCTTTC TATTTTCACT AAGAATTCTG	15840
ATTATGATAC GATTTCTAAG ATAGCCAAGG ATGTTTATGA GGTTCATAAA TGAGGGAACC	15900
AGATTTTTTA AATCATTTTC TCAAGAAGGG ATATTTCAAA AAGCATGCTA AGGCGGTTCT	15960
AGCTCTTCT GGTGGATTAG ATTCCATGTT TCTATTTAAG GTATTGTCTA CTTATCAAAA	16020
AGAGTTAGAG ATTGAATTGA TTCTAGCTCA TGTGAATCAT AAGCAGAGAA TTGAATCAGA	16080
TTGGGAAGAA AAGGAATTAA GGAAGTTGGC TGCTGAAGCA GAGCTTCCTA TTTATATCAG	16140
CAATTTTCA GGAGAATTTT CAGAAGCGCG TGCACGAAAT TTTCGTTATG ATTTTTTCA	16200
AGAGGTCATG AAAAAAGACG GTGCGACAGC TTAGTCACT GCCCACCATG CTGATGATCA	16260
GGTGGAAACG ATTTTATGCT GCTTGATTCT AGGAACTCGC TTGCGCTATC TATCAGGAAT	16320
TAAGGAGAAG CAAGTAGTCG GAGAGATAGA AATCATTCGT CCCTTCTTGC ATTTTCAGAA	16380

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AAAAGACTTT CCATCAATTT TTCACCTTGA AGATACATCA AATCAGGAGA ATCATTATTT	16440
TCGAAATCGT ATTCGAAATT CTTACTTACC AGAATTGGAA AAAGAAAATC CTCGATTTAG	16500
GGATGCAATC TTAGGCATTG GCAATGAAAT TTTAGATTAT GATTTGGCAA TAGCTGAATT	16560
ATCTAACAAAT ATTAATGTGG AAGATTTACA GCAGTTATTT TCTTACTCTG AGTCTACACA	16620
AAGAGTTTTA CTTCAAACCTT ATCTGAATCG TTTTCCAGAT TTGAATCTTA CAAAAGCTCA	16680
GTTTGCTGAA GTTCAGCAGA TTTTAAAATC TAAAAGCCAG TATCGTCATC CGATTAAAAA	16740
TGGCTATGAA TTGATAAAAG AGTACCAACA GTTTCAGATT TGTAAAATCA GTCCGCAGgC	16800
TGATGAAAAG GAAGATGAAC TTGTGTTACA CTATCAAAAT CAGGTAGCTT ATCAAGGATA	16860
TTTATTTTCT TTTGGACTTC CATTAGAAGG TGAATTAATT CAACAAATAC CTGTTTCACG	16920
TGAAACATCC ATACACATTC GTCATCGAAA AACAGGAGAT GTTTTGATTA AAAATGGGCA	16980
TAGAAAAAAA CTCAGACGTT TATTTATGTA TTTGAAAATC CCTATGGAAA AGAGAACTC	17040
TGCTCTTATT ATTGAGCAAT TTGGTGAAAT TGTCTCAATT TTGGGAATTG CGACCAATAA	17100
TTTGAGTAAA AAAACGAAAA ATGATATAAT GAACACTGTA CTTTATATAG AAAAAATAGA	17160
TAGGTAAAAA ATGTTAGAAA ACGATATTAA AAAAGTCCTC GTTTCACACG ATGAAATTAC	17220
AGAAGCAGCT AAAAAACTAG GTGCTCAATT AACTAAAGAC TATGCAGGAA AAAATCCAAT	17280
CTTAGTTGGG ATTTTAAAAG GATCTATTCC TTTTATGGCT GAATTGGTCA AACATATTGA	17340
TACACATATT GAAATGGACT TCATGATGGT TTCTAGCTAC CATGGTGGAA CAGCAAGTAG	17400
TGGTGTATC AATATTAAC AAGATGTGAC TCAAGATATC AAAGGAAGAC ATGTTCTATT	17460
TGTAGAAGAT ATCATTGATA CAGGTCAAAC TTTGAAGAAT TTGCGAGATA TGTTTAAAGA	17520
AAGAGAAGCA GCTTCTGTTA AAATGCAAC CTTGTTGGAT AAACCAGAAG GACGTGTTGT	17580
AGAAATTGAG GCAGACTATA CTTGCTTTAC TATCCCAAAT GAGTTGTAG TAGGTTATGG	17640
TTTAGACTAC AAAGAAAATT ATCGTAATCT TCCTTATATT GGAGTATTGA AAGAGGAAGT	17700
GTATTCAAAT TAGAAAGAAT AATCTTTAAT GAAAAACAA AATAATGGTT TAATTAAAAA	17760
TCCTTTTCTA TGGTTATTAT TTATCTTTTT CCTGTGACA GGATTCCAGT ATTTCTATTC	17820
TGGGAATAAC TCAGGAGGAA GTCAGCAAAT CAACTATACT GAGTTGGTAC AAGAAATTAC	17880
CGATGGTAAT GTAAAAGAAT TAACTTACCA ACCAAATGGT AGTGTTATCG AAGTTTCTGG	17940
TGTCTATAAA AATCCTAAAA CAAGTAAAGA AGAAACAGGT ATTCAGTTTT TCACGCCATC	18000
TGTTACTAAG GTAGAGAAAT TTACCAGCAC TATTCTTCCT GCAGATACTA CCGTATCAGA	18060
ATTGCAAAAA CTTGCTACTG ACCATAAAGC AGAAGTAACT GTTAAGCATG AAAGTTCAAG	18120

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TGGTATATGG ATTAATCTAC TCGTATCCAT TGTGCCATTT GGAATTCTAT TCTTCTTCCT	18180
ATTCTCTATG ATGGGAAATA TGGGAGGAGG CAATGGCCGT AATCCAATGA GTTTTGGACG	18240
TAGTAAGGCT AAAGCAGCAA ATAAAGAAGA TATTAAAGTA AGATTTTCAG ATGTTGCTGG	18300
AGCTGAGGAA GAAAAACAAG AACTAGTTGA AGTTGTTGAG TTCTTAAAAG ATCCAAAACG	18360
ATTCACAAAA CTTGGAGCCC GTATTCCAGC AGGTGTTCTT TTGGAGGGAC CTCCGGGGAC	18420
AGGTAAACT TTGCTTGCTA AGGCAGTCGC TGGAGAAGCA GGTGTTCCAT TCTTTAGTAT	18480
CTCAGGTTCT GACTTTGTAG AAATGTTTGT CGGAGTTGGA GCTAGTCGTG TTCGCTCTCT	18540
TTTTGAGGAT GCCAAAAAAG CAGCACCAGC TATCATCTTT ATCGATGAAA TTGATGCTGT	18600
TGGACGTCAA CGTGGAGTCG GTCTCGGCGG AGGTAATGAC GAACGTGAAC AAACCTTGAA	18660
CCAACTTTTC ATTGAGATGG ATGGTTTGA GGGAAATGAA GGGATTATCG TCATCGCTGC	18720
GACAAACCGT TCAGATGTAC TTGACCCTGC CCTTTTGCCT CCAGGACGTT TTGATAGAAA	18780
AGTATTGGTT GGTGCTCCTG ATGTTAAAGG TCGTGAAGCA ATCTTGAAAG TTCACGCTAA	18840
GAATAAGCCT TTAGCAGAAG ATGTTGATTT GAAATTAGTG GCTCAACAAA CTCCAGGCTT	18900
TGTTGCTGCT GATTAGAGA ATGTCTTGAA TGAAGCAGCT TTAGTTGCTG CTCGTCGCAA	18960
TAAATCGATA ATTGATGCTT CAGATATTGA TGAAGCAGAA GATAGAGTTA TTGCTGGACC	19020
TTCTAAGAAA GATAAGACAG TTTCACAAAA AGAACGAGAA TTGGTTGCTT ACCATGAGGC	19080
AGGCATACC ATTGTTGGTC TAGTCTTGTG GAATGCTCGC GTTGTCCTATA AGGTTACAAT	19140
TGTACCACGC GCGCGTGCAG GCGGATACAT GATTGCACTT CCTAAAGAGG ATCAAATGCT	19200
TCTATCTAAA GAAGATATGA AAGAGCAATT GGCTGGCTTA ATGGGTGGAC GTGTAGCTGA	19260
AGAAATTATC TTTAATGTCC AAACCACAGG AGCTTCAAAC GACTTTGAAC AAGCGACACA	19320
AATGGCACGT GCAATGGTTA CAGAGTACGG TATGAGTGAA AAACCTGGCC CAGTACAATA	19380
TGAAGGAAAC CATGCTATGC TTGGTGACA GAGTCCTCAA AAATCAATTT CAGAACAAAC	19440
AGCTTATGAA ATTGATGAAG AGGTTGCTTC ATTATTAAAT GAGGCACGAA ATAAAGCTGC	19500
TGAAATTATT CAGTCAAATC GTGAAACTCA CAAGTTAATT GCAGAAGCAT TATTGAAATA	19560
CGAAACATTG GATAGTACAC AAATTAAAGC TCTTTACGAA ACAGGAAAGA TGCCTGAAGC	19620
AGTAGAAGAG GAATCTCATG CACTATCCTA TGATGAAGTA AAGTCAAAAA TGAATGACGA	19680
AAAATAACCC TGAGAGAGGC TGGAGCCTCT CTTTTTGTG CAGTTTAGGA GCTAAAGGGA	19740
ACAGAATGGA GAAAATGGAA CAAATGTGTT TTCTAATCTG TTAGACTGTA TCTAGAAAGG	19800
GGAAAATTAT GATTAAAGAA TTGTATGAAG AAGTCCAAGG GACTGTGTAT AAGTGTAGAA	19860
ATGAATATTA CCTTCATTTA TGGGAATTGT CGGATTGGGA GCAAGAAGGC ATGCTCTGCT	19920

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TACATGAATT GATTAGTAGA GAAGAAGGAC TGGTAGACGA TATTCCACGT TTAAGGAAAT	19980
ATTTCAAGAC CAAGTTTCGA AATCGAATTT TAGACTATAT CCGTAAACAG GAAAGTCAGA	20040
AGCGTAGATA CGATAAAGAA CCCTATGAAG AAGTGGGTGA GATCAGTCAT CGTATAAGTG	20100
AGGGGGGTCT CTGGCTAGAT GATTATTATC TCTTTCATGA AACACTAAGA GATTATAGAA	20160
ACAAACAAG TAAAGAGAAA CAAGAAGAAC TAGAACGCGT CTTAAGCAAT GAACGATTTT	20220
GAGGGCGTCA AAGAGTATTA AGAGACTTAC GCATTGTGTT TAAGGAGTTT ACTATCCGTA	20280
CCCCTAGTA AGTCATGCAA AAAAAATGAA AAAAATTAGA AAAAGTAGTT GACAAAAGTTT	20340
GAAAGGCTG TATAATAGTA AGAGTTGAAA ATAACAATC AGGTCCGTTG GTCAAGGGGT	20400
TAAGACACCG CCTTTTCACG GCGGTAACAC GGGTTCGAAT CCCGTACGGA CTATGGTATG	20460
TTGGCTCAGG ACCACTTGAT GAAAAAAGT TTAaaaaaac TTAaaaaTCT TCAaaaaAGT	20520
GTTGACAAGC GAAAGCAGTT GTGATATACT AATATAGTTG TCGCTTGAGA GAAGCAAGTG	20580
ACAAAGACCT TTGAAAAGT AACAAGACGA ACCAATGTGC AGGGCGCTAC AACGTAAGTT	20640
GTAGTACTGA ACAATGAAAA AAACAATAAA TCTGTCACTG ACAGAAATGA GTAAGAACTC	20700
AAACTTTTTA ATGAGAGTTT GATCCTGGCT CAGGACGAAC GCTGGCGGCG TGCCTAATAC	20760
ATGCAAGTAG AACGCTGAAG GAGGAGCTTG CTTCTCTGGA TGAGTTGCGA ACGGGTGAGT	20820
AACGCGTAGG TAACCTGCCT GGTAGCGGGG GATAACTATT GGAAACGATA GCTAATACCG	20880
CATAAGAGTA GATGTTGCAT GACATTTGCT TAAAGGTGC ACTTGCATCA CTACCAGATG	20940
GACCTGCCGT GTATTAGCTA GTTGGTGGGG TAACGGCTCA CCAAGGCGAC GATACATAGC	21000
CGACCTGAGA GGGTGATCGG CCACACTGGG ACTGAGACAC GGCCCAGACT CCTACGGGAG	21060
GCAGCAGTAG GGAATCTTCG GCAATGGACG GAAGTCTGAC CGAGCAACGC CGCGTGAGTG	21120
AAGAAGGTTT TCGGATCGTA AAGCTCTGTT GTAAGAGAAG AACGAGTGTG AGAGTGGAAA	21180
GTTCACTG TGACGGTATC TTACCAGAAA GGGACGGCTA ACTACGTGCC AGCAGCCGCG	21240
GTAATACGTA GGTCCCAGC GTTGTCGGA TTTATTGGGC GTAAAGCGAG CGCAGGCGGT	21300
TAGATAAGTC TGAAGTTAAA GGCTGTGGCT TAACCATA	21338

(2) INFORMATION FOR SEQ ID NO: 21:

- (i) SEQUENCE CHARACTERISTICS:
  - (A) LENGTH: 5273 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

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(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 21:

TGTTTTTAAA GAGCCGTGTC TGGATAGACT TTCGGACGCA ACGCTCTATT AGATAATGAA	60
CTGCCTATAC ACAAGATTTT TAACCTTAGT CGACATGAGC TGAAACCTCT TATTGTGTAA	120
GTAGTTCACA AAATATTATA CACCTATTTT ATGAATAGTC AACTGTCTTT ACAGTAAAT	180
TTTAGAAAAT CATGAAAATT TTCTCTTTCT TTCCATTTTA AGTGACATTC AGTCATTCTC	240
ACATCAAAAA AGCCCAGACG AAATGTCTG AGCATTCTTT TATCTAGTCG TTTAAGGAAG	300
TTGAGTTCAG TATGTTTAAA GTCTCTGTCC CATCATTTCT TCAACAAACC TTGTTCTTGG	360
AGAAACTCCT TGGCTACTTG CTTTGCTGAC TTGCCTTCAA CACCGACTTG GTAGTTGAGC	420
TGGCTCATCT GGCTTTCTGT AATCTTACCA GCCAATGTAT TAAGAACTCT TTCCAACCTCT	480
GGGTGTTTCT TGAGAAGAGC TTCTTTCATG AGTGGAGCCC CTTGATAAGG TGGGAAGAGT	540
TGCTTGTCAT CTTCCAAGAC CTGTAAATCA TAACGCTCCA ATTCCGCATC AGTCGAATAG	600
GCATCCGTGA TTTGAATATC CCCTGACTGA ATAGCCTGAT AGCGAAGGGC TGGCTCAATG	660
GTCGTACAT TGAGATTGAG ACCATACATT GATTGCAAGC CCTTATTTCC ATCTTCACGG	720
TCGTAAACT CGAGTGTAAT ACCTGCCTTC AACTGCCCTT CCACTTTTTT CAAGTCTGAA	780
ATGGTCTTCA AGCCATATTC TTGAGCAATC TTTTTCGGAA CAGCTACAGC ATAGGTGTTT	840
TGATAAGACA TGGGTTTGAG ATAGGCTAGA TGATCCTGCT TAGCAATGCC ATCACGCGCC	900
ACCTGATAAA CCTGTTCTGG TTCATGACTC ACCTTGGGTG ATGGTTGAAG CAAACTTTCA	960
GTCACCGTAC CAGTAAATTC AGGATAGATG TCAATATCGC CTTTTTTCAG AGCTTCATAA	1020
AGGAAGCTTG TCTTCCCAA ATTCCGGTTA ACAGTCGCAG TCATGCTGGT ATTTTCTTCA	1080
ATCAGCAACT TATACATATT GGCCAAAATT TCTGGTTCTG GACCTATTTT CCCAGCAATA	1140
ACCAAGTTTT CCTTCTCTTT TTGAACCAA AGAGCTGGAC TATAAGACAG ACCCAGTAAT	1200
AAAGCCACCA AGGCAAAACC TGAGAAAATC GTCCGTAATT TTGCTTTTTC CATCACTTTT	1260
AGTAGGAAGT TAAAGGCAAT GGCTAGCACT GCAGAAGAAA GTGCCCAAT CAAAATCAAA	1320
CTGGCATTAT TACGGTCAAT TCCCAAAAGA ATAAAGGAAC CTAGTCCCCC TGCACCAATC	1380
AAGGCCGCCA AGGTGCGCT ACCGATAATC AAAACAGCTG CCGTCCGAAT CCCAGACATG	1440
ATAACAGGCA TGGCGAGTGG AATTTCAAAT TTCTTGAGAC GTTCCCATCT GGTCAATCCA	1500
AAGGCAATCC CAGCCTCTTG CAGGTTCGGA TCAATTCCT TCAGCCAGT GATAGTATTT	1560
TGCAAAATAG GGAAAATCGC ATAAATCACT AGAGCTGTCA AAGCCGGCAA GGTCCCAATT	1620
CCCATCAAAG GGATAAGAG CCCCAACAAG GCCAGAGACG GGATGGTCTG GAAAATACCT	1680
GCAATCTGCA AGACCCAGTC GGCCAGCTTC TCATGATAGC GAAGAAAAC AGCCAAGGGA	1740

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ATCGCAAGCA AATAGCTAG TAACAAGGTC AAAAGCGACA ACTGCAAATG TTGAGATAGA	1800
GCTGTCAACC AATCACTAAA ACGATCCTGA AAAGTTGCAA TTAAATTAGT CATGAACACT	1860
ACCTCCAAAC AAGTCTGCTA CAAAGTCTGT TGCAGGCGCT TTAAAAATTG TCTCGGGATT	1920
CGCTACCTGG CGAATTTCTC CATCCTGCAA GACAGCAATA CGGTCCGCCA ACTTCAAGGC	1980
TTTCATCCGTA TCATGGGTTA CAAAAATCGT TGTCAATCCCA AACTCTTTAT GCAATTCTTT	2040
TGTCAGAACC TGCAACTGTT TTCTCGAAAT AGCATCCAAG GCCGAAAAGG GTTCATCCAT	2100
GAGGAAAATC TTGGGCTGAC CAATCATAGC TCGGACAATA CCGACCCGTT GCTGTTCTCC	2160
ACCAGATAAT TCACTAGGTA AGCGATGCCC ATACTCGGCT ACTGGTAAAC CAACCTTAGC	2220
CAAAAGCTCT TCTGTTTTCT TCGTAATTTC TTCCTTGCTC CACCCCTTCA TTTCAGGAAT	2280
GAGAGCAATA TTTTCCGCAA CTGTTAGATT TGGAAAAAGA GCAATAGCCT GTAAACATA	2340
ACCAGTAGAA AGACGAAGTT CACGCTCATC ATAGTCTTTG ATGCGCTTCC CATCCATATA	2400
AATATTTCCA TCAGTTGGTT CCAAAAGACG GTTAATCATC TTGAGCATGG TCGTCTTACC	2460
TGACCCAGAA GGCCCTACTA AAACCATAAA TTCCCCATCC TCAATCTGTA AGTTGACATC	2520
TCTCAAGACA TCCTTTTCTG TGTAGCGCAG TGCTACATTT TTGTATTCAA TCATTCTTTG	2580
TCCTCAATTT AAAACTTCCC TCGATTGGTC AAGTCTTCTA CCTTAGGCAT AACTTCCTTA	2640
TTATCCCAAT GCTCCACAAT TTTCCCGTTC TCTAAACGGA AGATATCGTA CTGGGCATAA	2700
GCAACGCCAT CAATCTGAGT CTGACCATAG CTAACCACAT AGTTTCCTTG TCCTAAGAGT	2760
TGGAAAACAA AGTCAAAAGT GACACTATAT TCAGCCACAT AGTTTTTATA AGCAGCACTT	2820
CCTTGTCCAA TATCATGATT ATGCTGAATC AAATCGTCTG CCACATAATC ACTCCACTGC	2880
TCTAGCTCCC CATTTTGGAA AATTTCTGTC AAGAAACGGC GAACCAGCTT TTTATTTTCT	2940
GCTTTCTTAT CCAATCCTT GATTTCAAAA TCTCCAAAAA TTTGATCTAG TTGGTCATTT	3000
TCAGGTGTTT GATAGTAGTC AATGACATCC CAATGCTCAA CAATACAACC ATTCTCATCC	3060
TCACGGAAG TATCCGTCGT CACCATTGA GCTTCTCCAC CATTAGATA TTGATGAACA	3120
TGAACAAAGA CCAGATTGCC ATCCTCAATG GTGCGGACAA TCTTAATCTG ACGCTCTGGA	3180
TGACGCTCAA AGAAATCTGC AAAGAAGGCT GCAAATCCTT CTTTCCCGTC AGGAACACCT	3240
GTCGAATGTT GGATATAGGT ATCCCTACA GACTGGGCTT GAGCCTCAGC AACTCGTCCG	3300
TCTTGAATGG CATGGATGTA TAGGTTGTGA GCATTTTCA CTTGTTGTGA CATATTCTAA	3360
ACCTCATTTT CCTTCTCTTT CAGATTCGCC AAAATCTTTT CTTGAAAACC TTCAAATTGG	3420
TGAATTTCTT CCTCTGAAAA TCCTTTGTAA AAGATAGTAT CCAATTTCTG ACTGACACGA	3480

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TGCCCCACTT CTTCTGCGA CTTGCCTAAC TCCGTTAAAA CTAAATACTT CTTACGCTTG	3540
TCTTTTCCAC ACGGACTAAC AATTACAAGC TTTTGTTCCT CTAGCTTTTT TATCATAGTC	3600
GTCAGCGTAT TATTGCAAG TCCAGTCGCA AGCGCGATAT CTGTGCGAGT TGCGCAGCCA	3660
GTTTCACTAT TCCATAAAAC CGCTAAAATC TTGCCCTGTT CACCCCTATA AAGAGCCTCA	3720
GGATCTTGAC TCAGTAACCT TTGAAAAATC CGCCCATTC ACAAACGAAT ATGATGGGCT	3780
AGCAAATGAC CATCTTTCAT AACACCTCCA ATTTATTTTCG ATATCGAAAT GAATAAAACA	3840
ATTGTAACAC TCATCGTCTT AACTGTCAAC TATTTCGATT TAGAAATAAT TTTTGATAAT	3900
TATCCACACC ACCATACTCC GGCTCAACTA ACTTTTAACG AGAGTTTCTA AACTCCTTCG	3960
TCCTCCAGTC TACAAAAGCC TTCCATTGCT ACTATCCTAT ATTTTATGAG GGGACACATT	4020
TTTCTATCA GACCATTAT TTTAAAGATA GAAGTAAATC ATAATTGCTT CCATCTGTTT	4080
TTTTATAGTA TATTGAAGTT AGACTAGAGC ACTGTATCTT CTAACACATT GATAGAAAGC	4140
GATTTGAAAT TCCCAATCAA TTTGTTCGTA TTTATAGCAT TTCGAACTG GAATAGGACA	4200
CCATGACTGC TAAAGATTT CTATAAATTC ATTTAATTTCT CAATCAAT TTGTTCATAT	4260
CTTATTTTAT TCCGTATATA TTTCACCTTA CCCTATCTTT TTCGTAGCAC CCTTCAAACA	4320
GCCTATCCCC TACCGTTTGA CGATTCCCTCA CTTGCTCCA CTTCCATTAC AGAAGTTTCT	4380
TCACTACTAT GGGCTCGGCT GACTTCTCAT GATTCTTGT TACTACTATT TGAACGCTCA	4440
CGAGATAGAT CTTACAAAAA ATGCTTTGAT CCACAATGGA ATCAAAGCAT TTTAAAGAGT	4500
TCCTCATACA TAAGCGCAGA AGTCGCGAGT CCTCTGTACT TGGCTTCTTC TCTTTTGACA	4560
AAGCGAGCCA AGTTGAGCAA CTCAGGTGCT GGATGTTTGG GATTTAGGAG CAATCACGA	4620
TTGACCAGGC CTGAGAGACG AACTGCCTGC AATTGCTCAT TTGTAGTAGG CAGTTTTTTA	4680
GTAGTCTCTA GGAGAGCAGC AACTAAATCT TCACTCAAAT CATGTGAGC ATGATTGTAA	4740
AGATCTTTTA TAAGGCTTTC TAGGTTTGGT TCTACCATCC CTACCACCTC CCTTATGGTT	4800
TAATAATGTT TAATCAAATC AACCGTTGAA CGATCCAATT TCTTCACCAA GGCTTGTAAG	4860
AAAGCTTGGC CTTCTAGGAA GTCATCCATT GCATAGAGGG TTTGGTGAGA ATGGATATAA	4920
CGAGCGCAGA CACCGATAGT TGTGTATGGG ACACCACCAT TTTTCAGATG AGCTGCACCT	4980
GCATCTGTTT CGCCTTTACC ACAGTAGTAT TGGTACTTGA TACCAGCTTC TTCAGCCGTT	5040
GTCAAAGGA AATCCTTCAT CCCTGGGAGA AGCAAGTGAC CTGGATCATA GAAACGAATC	5100
AAGGTTCCAT CTCCAATCTT GCCTTGACCA CCGTAGACAT CACCTGCTGG TGAGCAATCA	5160
ACTGCGAGGA AGACTTCTGG GTCAAACTTG GTTGTAGAGG TATGAGCGCC ACGCAGACCA	5220
ACTTCTCTTT GGACGTTAGA ACCCAGATAG AGTTCATTGC CGAGTTTTTG ACCCGATAAA	5280



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GCTTCAGCTA GCTCGCTTAC CATGAGGACA CCGTAGCGGT TATCCCAAGC TTTTGAGATG	5340
ATATTTTTTTT CATTGCGTGT CAAAATTGCA GAACTATCTG GTACAATGGT ATCACCAGGA	5400
CGGATGCCAA AACTTTCTGC CTCAGCCTTG TCCGCAAAAC CACCATCAAA AACGATATCG	5460
GCAATGGCTG GCATGGTTGG TCCCCCTTT CCACGAGTCA AATGCGGAGG AACAGAACCT	5520
GAAATCACAG GAATTTTCATG ACCATCACGA GTCAAGAGTT TGAAACGTTG GCTGCTAACC	5580
ACCATGGGGT TCCAGCCACC GATTTCTACG ACACGGAAGG TACCATCTGG CTTGATTTCG	5640
CTGACCATAA AACCAACTTC GTCCATATGA GAAGCGACCA AGACGCGCGG TGCATCCACA	5700
GCTTCTGAAT GTTTGATACC AAAAATACCA CCCAAGCCAT CTGTCACCAC TTCATCCACA	5760
TGCGGTGTCA ACTTTTCACG AAGATAAGCA CGGACAGGCG CTTTCATGACC TGAGACTGCA	5820
GCAAGTCTG TTAATTCTTT AATTTTGAA AATAATGTTG TCATTTCACT TCCTTCTTTC	5880
TTTCATCCAT TTTACCACTT TTTATAGGAG AAGGATAGTG GGAAGGTGGA TTTCTAAGTT	5940
AGTATCTTAG TCCTGCTCTA TCTTAGAAAA GGATAGTATT CTCTTGCATG TAGTGCAAAA	6000
TCTAGTAAAC ATTCCAAAAT TAACTCGAAT ATTTATTTCC AAACAAAAA ACAATACACC	6060
ATCAAAGTTG TTTGGATTTT TCATGAAATT TACAGAAAAT AGTTGACTTC CCTTCTTCT	6120
TTCTTTAAAT ATATAGTTGG TTGAGTTTGG AATAGTACGC TGTAGCTGCT AAAACATTTT	6180
TAGAAATTAA TTTGACTTTC CTAATAGAGT TGTTTCATATC TTATTTCAAT TTACTATAGT	6240
ACAAACTAG AAAAGGAAA AATCATGACC AGG	6273

(2) INFORMATION FOR SEQ ID NO: 22:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 28171 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 22:

ACAACCTTTT TCAAAAATC ACCTTGGTAC GGAGATGTTT TGCTTTCTGC TATTATTTTC	60
GGTTATATTC ATATCAATTT TGCTTTAACT CCTCTTGCTT TTTTCATTTA TGCTAGTGGA	120
GGTCTTATTT TAGCTCTATT GTATCGCATG ACTAAAAATC TCTACTATCC AATACTAGTT	180
CATATTTCTCA TTAATATCAC TGCCTTCTGG GATGTGTGGT TGCTCCTATT TTCAGGAAGT	240
TAGCTTACTA AAATAATGTC GGAACTTTCC GGCATTTTCT TTTTTCACAA ATAGTCAACG	300
TTTTTCTTTT CGATATTGTA GTGGTGTGTA TCCAGTTATT TTTTGAATT GATTTTGAAA	360

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ATAAGGTTGA	CTTGAGAAAG	GCAGATAGTG	AAGATAGTTA	AGAAGAATAG	GATGTTCTTT	420
TTTCCTTTT	GGAAACTTC	TAAATATGG	TATAATGAAA	AGATAAAGAA	GTTGGGGTA	480
GAAGATGAAC	ATTCAACAAT	TACGCTATGT	TGTGGCTATT	GCCAATAGTG	GTACTTTTCG	540
TGAAGCTGCT	GAAAAGATGT	ATGTTAGTCA	GCCGAGTCTG	TCTATTTCTG	TTCGTGATTT	600
GGAAAAGAG	TTGGGCTTTA	AGATTTTCCG	TCGGACCAGC	TCAGGACTT	TCTTGACCCG	660
TCGTGGGATG	GAATTTTATG	AAAAATCGCA	AGAATTGGTT	AAAGGATTG	ATATTTTCA	720
AAATCAGTAT	GCCAATCCTG	AAGAAGAAAA	AGATGAATTT	TCTGTTGCTA	GCCAGCACTA	780
TGACTTCTTG	CCACCAACTA	TTACGGCCTT	TTCCAGAGCG	TATCCTGACT	ATAAGAACTT	840
CCGTATTTT	GAATCAACTA	CTGTTCAAAT	ATTAGATGAA	GTGGCGCAAG	GGCATAGTGA	900
GATTGGGATT	ATCTACCTCA	ACAATCAAAA	TAAAAGGGG	ATTATGCAAC	GGGTTGAAAA	960
ATTAGGCTG	GAGGTCATCG	AATTGATTCC	TTCCATACC	CATATTTATC	TCCGTGAGGG	1020
TCATCCTTA	CCCCAGAAAG	AGGAATTAGT	CATGGAGGAT	TTAGCGGATT	TACCAACGGT	1080
TCGTTTCACT	CAAGAGAAAG	ACGAGTACCT	TTATTATTCA	GAGAACTTTG	TCGATACCAG	1140
CGCTAGCTCA	CAGATGTTA	ATGTGACAGA	CCGTGCCACC	TTGAATGGTA	TTTTGGAGCG	1200
GACGGACGCC	TATGCGACAG	GTTCTGGATT	TTTAGATAGT	GACAGTGTTA	ATGGCATTAC	1260
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GGAGCTTAGT	CAAGCTGGGA	CTCTCTCTG	AGAAGTCATG	CAAGAATATT	TTGATCAAAA	1380
GAGGAAATCA	TGAAAAAAG	AGCAATAGTG	GCAGTCATTG	TACTGCTTTT	GATTGGGCTG	1440
GATCAGTTGG	TCAAATCCTA	TATCGTCCAG	CAGATTCCAC	TGGGTGAAGT	GCGCTCCTGG	1500
ATCCCCAATT	TCGTTAGCTT	GACCTACCTG	CAAAATCGAG	GTGCAGCCTT	TTCTATCTTA	1560
CAAGATCAGC	AGCTGTTATT	CGCTGTCATT	ACTCTGGTGG	TCGTGATAGG	TGCCATTTGG	1620
TATTTACATA	AACACATGGA	GGACTCATTC	TGGATGGTCT	TGGGTTTGAC	TCTAATAATC	1680
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CACCTTGACT	TTATCAACTT	TGCAATTTTC	AATGTGGCAG	ATAGCTATCT	GACGGTTGGA	1800
GTGATTATTT	TATTGATTGC	AATGCTAAAA	GAGGAAATAA	ATGGAAATTA	AAATTGAAAC	1860
TGGTGGTCTG	CGTTTGGATA	AGGCTTTGTC	AGATTTGTCA	GAATTATCAC	GTAAGTCTCGC	1920
GAATGAACAA	ATTAAATCAG	GCCAGGTCTT	GGTCAATGGT	CAAGTCAAGA	AAGCTAAATA	1980
CACAGTCCAA	GAGGGTGATG	TCGTCACTTA	CCATGTGCCA	GAACCAGAGG	TATTAGAGTA	2040
TGTGGCTGAG	GATCTTCCGC	TAGAAATAGT	CTACCAAGAT	GAGGATGTGG	CTGTCGTTAA	2100
CAAACCTCAG	GGAATGGTTG	TGCACCCGAG	TGCTGGTCAT	ACCAGTGGAA	CCCTAGTAAA	2160

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TCCGTGATAA GAAGGCTCGT TATGAAAAAA TTGCAGAGCG TGCCCTTGCC GACTTAGAGG	14820
AATTTTGTAC TGTCTAATTT TTTTGAAAGA ATTGCTCATG ATACTATAAA AATCTTAGAA	14880
ATTGTGATAA AATAGGTAGG ATGAAAGAAG GAGAGTGAAA ATGGCGAATC CCAAGTATAA	14940
ACGTATTTTA ATCAAGTTAT CAGGTGAAGC CCTTGCCGGT GAACGTGGCG TAGGGATTGA	15000
TATCCAAACA GTTCAAACA TCGCAAAAGA GATTCAAGAA GTTCATAGCT TAGGTATCGA	15060
AATTGCCCTT GTTATCGGTG GAGGAAATCT CTGGCGTGA GAACCTGCAG CAGAAGCAGG	15120
TATGGACCGT GTTCAGGCAG ATTACACAGG AATGCTTGGG ACTGTTATGA ATGCTCTTGT	15180
GATGGCAGAT TCATTGCAAC AAGTTGGGGT TGATACGCGT GTACAAACAG CTATTGCCAT	15240
GCAACAAGTG GCAGAGCCTT ATGTCCGTGG ACGTGCCCTT CGTCACCTTG AAAAAGGCCG	15300
TATCGTTATC TTTGGTGCTG GAATTGGTTC ACCTTACTTC TCGACAGATA CAACAGCGGC	15360
CCTTCGTGCA GCTGAAATCG AAGCAGATGC CATCCTCATG GCTAAAAATG GTGTCGATGG	15420
TGTTTACAAT GCCGATCCTA AGAAAGATAA GACAGCTGTT AAGTTTGAAG AATTGACCCA	15480
CCGTGACGTT ATCAATAAAG GTCTTCGTAT CATGGACTCA ACAGCTTCAA CCCTCTCAAT	15540
GGACAACGAC ATTGACTTGG TTGTATTCAA CATGAACCAA CCAGGCAACA TCAAACGTGT	15600
CGTATTGGT GAAAATATCG GAACAACAGT TTCAAATAAT ATCGAAGAAA AGGAATAAGA	15660
AAGAATATGG CTAACGCAAT TATTGAAAA GCTAAAGAGA GAATGACCCA GTCTCACCAA	15720
TCACTTGCTC GTGAATTTGG TGGTATCCGT GCTGGTCGTG CCAATGCAAG CTTGCTTGAC	15780
CGTGATCATG TAGAATACTA TGGAGTCGAA ACTCCTCTTA ACCAAATCGC TTCAATTACG	15840
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GAACGTGCCT TGAACGCTTC TGATATTGGT ATCACACCGG CTAATGACGG TTCTGTGATT	15960
CGCTTGGTTA TCCCAGCTCT TACAGAAGAA ACTCGTCGTG ACCTTGCTAA AGAAGTGAAG	16020
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GCTAAGAAAC GAGAAAAAGC AAAAGAAATC ACTGAAGACG AATTGAAGAC TCTTGAAAAA	16140
GACATTCAAA AAGTAACAGA CGATGCTGTT AAACACATCG ACGACATGAC TGCTAACAAA	16200
GAGAAAGAAC TTTTGAAGT CTAAAAATAA ACAGAAAAAC TCAGTTGGCA TTGCTGGCTG	16260
AGTTTATTC GAAAGAAGGA AATATGAATA CAAATCTTGC AAGTTTATC GTTGGACTGA	16320

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GAGGAAGTTC GCCTGCAAAA GAATAGACTT GTTCGGTAAC TGTAAGAAAGT GTTATACTAT	18480
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GCCCTATCTG	GCATGCAGGT	AGSTTTTTTC	ATGAATGGAT	TTAAGAACT	TCTCTTGCGA	23940
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TCAAAAGTCG	AGGAGTAGCT	AAGATTGACC	AGCTAATTTT	GACTAACACG	GACAAGGAGC	24840
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TGGAGAGCAG GTTGGAAGT CGCATTGCAG CCAACGAGAG GGCTATCAAT GAAAATGAAG	26580
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GGATTGATCA GATTGTCTGG ATTTTAGAGG TTATCATCCC AAGTTTGT TTGGTTGCTA	26940



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(2) INFORMATION FOR SEQ ID NO: 23:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 7147 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 23:

CCGCTCAACT TTGCAATCA AGGCTAAGTA GACAGCAGCA AATTTCATAT TGTATAATTT	60
CTGACTCATA CTTCTCTCTT TCTATGTGTA CTAGTATAAA TAAGAAAAAG AAGGCCGTCA	120

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AGCCTTCTTT TGATTATTC TTCTGCTTCA TCTTCTGTAA ATTGACTATT GTACAAGTCA	180
GCGTAGAAGC CACCTTGCGC CATCAGTTCC TCATAGTTGC CTTGCTCGAT GATATTTCCA	240
TCTTTCATGA CCAAGATCAA GTCTGCATT TCGATGGTTG ACAAGCGGTG GGCAATGACA	300
AAGGATGTGC GTCCTTCCAT CAAACGGTCC ATGGCTTTT TGGATCAATTC CTCTGTCCGT	360
GTGTCAACAG AAGAAGTCGC CTCATCCAAA ATCAAAAGCG GTGCATCCTT AAGAAGGGCA	420
CGAGCAATAG TCAATAGTTG TTTTGTCTT ACAGACAAGG TCACGGTGTC ATCCAAGATG	480
GTATCATAGC CATCTGGCAA GGTCAATAA AAGTGGTGAA TTCCACAGC CTTACTAGCT	540
TCCATCATTC GTTCATCACT AATCCCTATT TGATTATAGA TGAGATTGTC TCGAATAGTT	600
CCTTCAAAGA GCCAGGTATC CTGCAAGACC ATTGAAAAG CATCATGCAC TTCTGAACGC	660
GTTCATAGCCT TGGTATCCAC ACCATCAATG CGAATACTTC CCTTATCAAT CTCATAGAAT	720
TTTCATCAAAA GATTGACAAT GGTGTCTTA CCAGCCCCAG TCGGCCAAC AATGGCAACC	780
TTTTGACCAG CATGAGCTGT CGCAGAGAAG TCATAGTCTT GAACATTGAC ACCGTCCACC	840
AGAATTTCTC CTGCTGACAC GTCGTAGAAA CGTGAATCA GATTGACCAG AGTTGATTTA	900
CCAGAACCCTG TTGACCCAAT AAAGGCCACT GTTTGACCAG TTTCTGCTT AAAGCTAACA	960
TGTTCAATAA CTGCCCTCCGA ATTTGCCGCA TAGCGAAGG TCACATCCTT AAACGCGACC	1020
TGACCTTTGA AGTTTTCATC AGTCAGCTGC ACTTGAACAG GGTTTTGGAT AGAAGAATGC	1080
AAATCTAAAA CTTGATTAAT CCGCTTAGCA GAGACCATAG TTCGGGGAAG AACGATGAAG	1140
AGTGCTCCCA TGAGAAGGAA GCCCATGACA ACCTACATGG CATAAGACAT GAAAACAATC	1200
ATGTCACTAA AGAGAGGCAG ACGCGCTATC GGAGCAGCGT CGTTAATCAC ATAGGCCCA	1260
ATCCAGTAAA TCGCCACACT CAAACCACTT GAAATCCCA TCATGATAGG ATTCAAAATA	1320
GCCATAAGAC GGTGACAAA CAAATTCAAA CGGGTCAATT CATCATTTAC TGCTGCAAT	1380
TTTTCATTTT GATAATCCTC TGCATTGTAG GCACGAACGA CACGAATACC TGTAAACTC	1440
TCACGAGTGA TACTGTTCAG TTTATCTGTC AGCCCCTGAA TCAAGGACTG TTTTGAAAG	1500
GCTAGCGTCA TCAAAACGGT CGTCATCAGG ACGTTGATAA TCACTGCCAC AAGTACGGCC	1560
CAGAGCCAGT ATTCTGAATG ACCTAAAAATC TTCCAATAG CCCAGATAGC CATAATTGAA	1620
CCACGCGTTA CCACTTGCAA GCCCATAGTA ATCAACATTT GAACTTGAGT AATGTCATTG	1680
GTAGTACGCG TCAAGAGGCT AGGAATTGAA AATTTCTTAA TCTCTGTCTG CGAGTAATCC	1740
AAAACGCGT TAAAAATATC ACTTCTCAGC CTAAGTAGTAT AAGAAGCCGC CACTCGGGAT	1800
GCAAAAAATC CAACTGCAAC TACGGACAAG AAGGCAAGAA AGGACATTCC CATCATCATG	1860
CTTGCCGACT GCCACAATC ATCTAAATTA GTTCTTGAC TACCTAGCAA ATCCGTAATT	1920

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TTCGAGATAT AGGTCCGGCAC TTCCAACCTCT AGATAGACCG AAAAGCAAGT AAAGAGAATG	1980
GCTAGTAAAA TCATCCCCCA TTCTTTTCTA CTAATTCCTT TGGCTAATTT CTTTATTCTC	2040
TCCTCCTATT CCCTTGATAT TTTGCTGTGTA GTTGACCGAG AACCTTCTCA AAAATCAGTA	2100
ATTCATCTTC ATCAATGTCT TCCATCAACT GCTTGTCTAT GCGTTCAAAA AAAGCCTTAA	2160
CCTGTTGCAT CTGAGAACGT GCTTGTGCCG TCAGACGAAC AAACCTTAGCC CGCTTATCAA	2220
CAGGACTCGC CTCCAATTCC ACCAAACCAT TTTGCACTAT ACGCTTAACC AGATTACTAG	2280
CAACAGGCTT GGTAAATATG AGTTCCTGCT CGATATCTTT AATCAAGACC AAGTCTTGGT	2340
TTTTCTCGCG ATTATCCAAA AAACGCACAA CCTGACCTTG CGGCCACCC ATAAATTCAA	2400
TGCCGCAACG TTTGGCTTCC TTTGCACCA TCAGGTGAAT TTGATGACCA AAACGCTTAA	2460
AGACTAACAT CGGTTTATCC ATAATCTCCC CCTTCTAAAT AAAAATAGTT CTCTGGAGAA	2520
TAATTAAAT TCTATGAGAA CTATTTTCTT GATTAAAAA ATCCAAGTG ATTTTCTCAC	2580
TTAGGATCAT GTTCTATAGG TTAAATPAAA ACCCATCTAC GTTCGTATAA ATCTTTTGGA	2640
CGTCTTCGTC GTCTTCAAGA ACGCTGTAAA GTTTTTCAA GGTTPCAAG TCTTCGCCTG	2700
ACAATTCAC TTCTGACTGA GGAATCATTT CCAATTCAGT CACTTGAAT TCTTCAATAC	2760
CAGACTCAG GAGGGCAACG ATAGCCTTGT GAAGGTCAGT TGGCGCTGTG TAAACTGTGA	2820
TTGTACCTTC TTGTGCTTCT ACGTCATCCA CATCCACATC CGCTTCGAGC AATTGCTCAA	2880
AGACTGCGTC CGCATCTTCA CCTCCAAATA CAATAACACC TTTGTTGTCA AAGAGGTAAG	2940
AAACAGAACC TGAAGCGCCC ATGTTTCCGC CGTTTTTACC AAAGGCTGCA CGGACATTGG	3000
CTGCTGTACG GTTGACGTTA GAAGTCAAAG TATCCACAAT TAGCATAGAG CCATTTGGCC	3060
CAAAACCTTC GTAACGTCCT TCTGTAAAGG TTTCGTCTGT GTTTCCTTTG GCTTTATCAA	3120
TCGCTTTATC GATAATGTGT TTTGGCACTT GGGCTTGT TTAGCACGTCG ATAACGAATT	3180
TCAAAGCTGA GTTTGATTCT GGATCTGGAT CACCTTTTTT AGCTGCTACA TAGATTTCTA	3240
CACCAAATTT TGCATATACT TTAGAGTTAG CTCCATCTTT AGCCGTTTTT TTGGCTACGA	3300
TATTGGCCCA TTACGTCCC ATTAGGAATC TCCTTTTTTC ACATTTTAAT CTTTCTTATT	3360
ATAACACAAG TTTTTTTGAT TTCACTAGA GGAAATGGAT TTTATTAGCA AATCAAGCTA	3420
GGATAGCACT TTACCTGCTA AGATGGTCTT GCCTTCTAT CTTTATCAAC AGGCACTCAT	3480
CCACATTCAA AAAACAAACT AGACCATTAT CTGCAAATAG AAAGTTTCAG CCAAGTTTGA	3540
CAAAGTCAGC TCAAATTACT GTTTGAAGTT TGTAGATATA AGCGACAAAA ACAATCATAC	3600
TGCACCTTTT GTTGACAGTC TACTCCAGAC ATATCATAGT TCAAGTAAAT ACTTTGAAAT	3660

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TCAACAGTTC TTATAGGCGC TATTGTATTC TAAGAAATCA ATAGAAGAGT TTCTAAGCAA	3720
ACCTCTAATA CTCRAATAAAA ATCAAAGAGC AAACCTAGAAA GCTAGCCTCA GGTTGCTCAA	3780
AACACTGTTT TGAGGTTGCG GATGGGGCTG ACATGGTTTG AAGAGATTTT CGAAGAGTAT	3840
AATTTACGTG TTCCCAAGAT GGAGAAGTTA GACTAGTACA CTGGCACTTC TAAAACATTG	3900
CTAGCAATTG ATTTGTTTAT ATTTAATTTC ATTTTTTCCA TAAATGGGTA TTAGATATAA	3960
ACAGCAAAAT ATTTCCGATA CGTGTCGTTC TTGAATTTCC AATCATCTAA AACAAGTAAA	4020
GGATAATCAA TCCCCTGTAT ATCAAGGAAT TGGCTACCCT TTTTACTTTT TTACACATTC	4080
TGTTTGATAG ATTCATTTTA ACATCACGAG CATACTCCAA TGGAAATCGC TAGGCAAGAG	4140
ATAAACTTTC AGATATCCGC AGAGAGATCA TCGCCTCTTT TTGTCGCAAG CATTCTCCTC	4200
TCCTAGTCAT TTTCTACCTT ATCTTCTACC TGAGGATAGA GAGTTGTTCC CCAAATAGAA	4260
ATCGTCCGCT TACGCACTAG TGGCAAAATCG GTTTTTCAT AAACCGTACG CCACCATTCC	4320
CAGGCAAGCC CGGTACACTC TCTAATTTTG ACAGAGAGAT TACGAACATT CCCTTTTAAA	4380
GGAACTAGT TGGTAAAGTG AGCCGTAAA TCCTGCCCAT TTCTGTCCCA AGCCTTAGGA	4440
GTCAAGACTT CCTTACCTTG ATGATCATAG GATAATTCAT TCCAAGTAAT ATAATATTGG	4500
GCAACATAGG CACCACTATG ATCCAGCAGT AAATCTCCGT TTCTGTAAGC TGTAACCTTA	4560
GTCTCAACAT AGTCTGTACT ATTTTGAAAG GTCGCACTA CATTGTCACG TAAAAAGAA	4620
GTTGTATAGG AAATCGGCAA GCCTGGATGA TCTGCTGTAA AGCGACTGCC TTCTTGAATC	4680
AAGTCTCTA CCATATCCAC CTTGCCGTGTT ACAACTCGGG CACCCGAAC TGGGTCGCCC	4740
CCTAAAATAA CCGCCTTCAC TTCTGTATG TCCAAAATCT GTTCCACTC TGTCTGAGGA	4800
GCTACCTTGA CTCCTTTTAT CAAAGCTTCA AAAGCAGCCT CTACTTCATC ACTCTTACTC	4860
GTGGTTTCCA ACTTGAGATA GACTTGGCGC CCATAAGCAA CACTCGAAAT ATAGACCAA	4920
GGACGCTCTG CAGAAATGCC TCTCTGTTT AAATCCTCTA CCGTTACAGT ATCTTGAAAC	4980
ACATCTCCTG GATTTTAAAC AGCATCTACG CTGACTGTAT AATAAATCTG CTTAAAATTA	5040
ACAATCTGAA TCTGCTTTTC GCCTGAATGG ACAGAGTTAA AATCAATATC AAGAGAATTC	5100
CCTGTCTTTT CAAAGTCAGA ACCAACTTG ACCTTGAGTT GTTCCATGCT GTGAGCCGTG	5160
ATTTTTCAT ACTGCATTCT AGCTGGGACA TTATTGACCT GACCATAATC TTGATGCCAC	5220
TTAGCCAACA AATCGTTTAC CGCTCCGCGA ACATTGAAT TGCTGGGGTC TTCCACTTGG	5280
AGAAAGCTAT CGCTACTTGC CAAACCAGGC AAATCAATAC TATAAGTCAT CGGAGCACGA	5340
TCGACCGCAA GAAGAGTGGG ATTATTCTCT AACAAAGTCT CATCCACTAC GAGAAGTGCT	5400
CCAGGATAGA GCGACTGTC GTTGGTAGCT GTTACAGAAA TATCACTTGT ATTTGTCGAC	5460

AAGCTCCGCT TCTTCTTTC GATAACAACA AACTCATCGG GTAGCTGATT ACCCTCTTTG	5520
ATGAAACGAT TTTCAATACT TTCTCCCTGA TGGGTCAAGA GTTTCTTTTT ATCGTAATTC	5580
ATAGCTAGTA TAAAGTCATT TACTGCTTTA TTTGCCATCT TCTACCTCCT AATAAGTTCC	5640
TGGATPGAGT TGCATAAACT CAGACTTGTT CAGCGAAATC AGCCGTGGTT GGACTAAGTA	5700
ATCCAAAATT TCCTCGTACA ATTCTTCTGA GACATTGCGT CGCCGTCTGG CTAAATAAGA	5760
AGTCGGAATG ACCGTATTAT CCAACATAAA TACCTTATCT AAGTCAATCA AGGTGGTCT	5820
TGTAAAAGGA TTACGAGCTA GATCCGGCTC TTCTATCATA AAGTTCTTGA CCAAACGTCT	5880
GGTCAAGAGA GCTGGTTTGA AGGTCTGATT TTAACCAAC TCTTTGTTTT TAGTCATGCT	5940
GTTGTCAATA CAGATATACA TATGATTCTT CACAGCCAAA TCGCTACTAA TAGTCGGAAA	6000
AGGCAAAATA AGAGCTACAA CATCTCCTCT CTTAATCAAG CAAGAGCACC CCCTTTTCTC	6060
CTAATGTAAC ATAGACAGGA TTGACCAAGT CTTCTGATTG ACTCAGAATT TCCAAAGTTT	6120
GAGTTTGGCG CGCTGTCAAT TTAGTAGCAT CTTGTCTCTT CAATACAAA TGCTTGTCGC	6180
CAATAACCTT GACAATATAA TCCTTCTCCA AAGCTGACTG GTAAATCCAC ATCAGATGTT	6240
GTCTGTCTCG AGAACTCAAG AGAGAAGGAT TTTCAAGCCT CCCGATAGTC TGATAAAAT	6300
CAAAAACAGG AGCTAACTCC TGCCAATCTG ATTGGCTAGT TGTCAAGGCT AGAAAAGGG	6360
CTTTGCGAGC TGATACTTCT TGGTTAGCCT TGAGAGTTAC TTTCCTCTCC AAGTTTMTTA	6420
GAAATCGGGA AACTCCAGAA AGCAAATTTT TCTCTAACTG CGAGAAATAA AAACCTTTTCG	6480
TTCCCAGACA TAAGTCTTTC ATGTGCTTTT CTCTAGCAAA TAAGAGCTCA AACATTTGAT	6540
AGTAAAAGAA AAATATCTGG CACTGGGTCG CGCTCATCTT TTCCTTATCG GCTTCTTTTT	6600
TTAACCAGAG CAAGGGCGAC AGGTAGCTGG ATTGAGACAT TTCCTCTACC TCCTACTCTT	6660
TTTTAACTGG AGCATCTGCA CTAGCTGCCA CTTCTTTTGA CTGGATACTT TCCCACTGGT	6720
TAATCTCCTC TGAGATAAGA CCTTCGCATG TCTTGACAAA TAGGGCAAAA GCCTTGGTCT	6780
TTCTGCATA TTTCTCCGTT TGGCATTGAT AGAGGAATTT TTCTTTCTCC AGGAGTTGCG	6840
CAGTTTTTTG GTAAGAAATC CAATTTTCCT TTGCATTATA CAAATTGATA ATCCCTCAC	6900
ACAGCAAGCC GAGACTGGAT AAGGCAACCG AAATCAAACG GTAGCGATCA CCTGGCATAG	6960
GAATAGCACA AAAGACAGCT ATGAGGAAAC CTGCCACGAT TTCTGTTATT TTAAATACCT	7020
TATAGCGCCT ACGATGTTGA ACGCTTTTCT TTAAAAATG AGCTATCTGT ACGTCTAATC	7080
GCTCTGTCTCAG GTACATTTCT TCTGGCGTCA TATTGTAAC TCCTTTCATT TACTTTGATA	7140
ATCAGGG	7147

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## (2) INFORMATION FOR SEQ ID NO: 24:

- (i) SEQUENCE CHARACTERISTICS:  
 (A) LENGTH: 755 base pairs  
 (B) TYPE: nucleic acid  
 (C) STRANDEDNESS: double  
 (D) TOPOLOGY: linear

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO: 24:

CCGCATGGGA TTGGTGTCTT TTTGGGCAAT CTCCTTGACC AAAC TGAAA CATGTTTAT	60
GCGCTGCCT TTAGTCCCCT TGTCGGCGGT ACGTCTATAT GATCCTAGTC GCAAAAGTTC	120
CGCGCTTTGG AGCCATTACC ACTATCGGCC TTGTCATTGC CCTCTTTTTC TTGGGAACTA	180
AACACGGTGC TGGTTCCTTC CTTCTGGAA TTATCTGTGG CCTCCTAGCA GATGGAGTAG	240
CTCATTTAGG AAAATACAAG GACAAAACAA AGAACTTCCT TTCTTTCATT ATTTTCGCCT	300
TTAGTACAAC AGGACCAATC TTGCTTATGT GGATTGCGCC CAAAGCCTAT ATGGCTACTC	360
TTCTGGCAAG AGGAAATCC CAAGAATATA TCGACCGTAT CATGGTCGCT CCAAACCTG	420
GAACGTCTCT TCTATTTATC GCAAGTATG TCATCGGAGC CCTAGTGGGT GCCTTGATTG	480
GACAAGCCTT GAGTAAAAA TTGCCCAGA AAATCTGATC AGTTAAAAAG AGCCACGCGG	540
CTCTTTTITA TTTATGGCTC AATTCTTAG TCAAGAAATC TCCAAGAAAT TGGATTGCAA	600
AGATAATCAA AATGATAATA ATGGTTGCCA AGATGGTCAC ATCGTGATTG TAGCGGTTAA	660
ATCCATAAGC GATGGCTACG TTACCGATAC CACCAGCTCC AACCACACCG GCCATAGCTG	720
TTtccCAACA AGGGaAtCAA GGTcACAGTC GTCAC	755

## (2) INFORMATION FOR SEQ ID NO: 25:

- (i) SEQUENCE CHARACTERISTICS:  
 (A) LENGTH: 3010 base pairs  
 (B) TYPE: nucleic acid  
 (C) STRANDEDNESS: double  
 (D) TOPOLOGY: linear

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO: 25:

TTCAATTGGT ATCTCAATCA ACGGTCTTCA CATGGTTTCA ACTGGTTTGA CTCTTGAAAA	60
AGCGAAAGCT GCTGGTTACA ACGCAACTGA AACAGGCTTT AACGATCTTC AAAAACCAGA	120
ATTCATGAAA CATGACAACC ATGAAGTAGC AATTAAGATT GTCTTTGACA AAGATAGCCG	180
TGAAATTCTT GGTGCCAAA TGGTTTCACA TGATATTGCA ATTAGCATGG GAATCCACAT	240
GTTCTCACTT GCTATCCAAG AGCATGTGAC AATTGATAAA TTGGCATTGA CAGACCTCTT	300

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CTTCTTGCCA CACTTCAACA AACCATACAA CTACATCACA ATGGCTGCCC TTACGGCTGA	360
AAATTAATAA TGAATGAGCT ATCTGGCCTT AAGTTAAGGT CAGATAGTTT TTAGCTAATT	420
TGTCCCCATA CAATTATAGT TTTTATCT TGTGCTTCAT TCTGTTCTGA CTAAAAATGA	480
AAAGGTAGCT ACCAATACAA ATGATGAGGA TAAACAAAT GACTGAAAAT CGTTATGAAC	540
TAAATAAAAA CTGGGCACAG ATGCTCAAGG GTGGTGTAT TATGGATGTG CAGAATCCTG	600
AACAGGCTCG TATCGCAGAA GCTGCTGGTG CGGCAGCTGT GATGGCCTTG GAACGAATTC	660
CGGCTGATAT TCGTGCAGCT GGAGGAGTTT CCCGCATGAG CGACCCAAAG ATGATTAAGG	720
AAATCCAAGA AGCGGTTAGT ATTCCAGTAA TGGCTAAGGT CAGAATCGGG CATTTTGTGTG	780
AAGCTCAGAT TTTAGAGGCT ATTGAAATTG ATTATATCGA CGAGAGTGAA GTTCTATCTC	840
CAGCTGATGA CCGTTTCCAT GTGGACAAGA AAGAATTCCA AGTTCCCTTT GTCTGTGGTG	900
CTAAGGATTT GGTGAAGCC TTGCGTCGTA TCGCTGAAGG TGCTTCCATG ATTCGTACCA	960
AAGGAGAACC AGGGACAGGG GATATCGTCC AAGCTGTTG TCATATGCGT ATGATGAATC	1020
AGGAAATTCG CCGCATTCOA AACTTACGTG AGGACGAGCT TTATGTTGCT GCCAAGGATT	1080
TGCAAGTCCC TGTAGAATTG GTCCAATATG TTCATGAACA TGGAATTTG CCAGTTGTAA	1140
ATTTCGCTGC TGGAGGTGTT GCAACGCCAG CAGATGCTGC GTTAATGATG CAATTAGGGG	1200
CAGAGGGGGT CTTTGTGGT TCAGGTATTT TCAAGTCAGG AGATCCTGTT AAACGAGCGA	1260
GTGCCATTGT TAAGGCTGTG ACTAATCTCC GTAATCCTCA AATCCTAGCT CAAATCTCTG	1320
AAGATTTAGG AGAAGCCATG GTTGGTATTA ATGAAAATGA AATCCAAATT CTCATGGCTG	1380
AACGAGGAAA ATAGATGAAA ATCGGAATAT TGGCCTTGCA AGGGGCCCTT GCAGAACATG	1440
CAAAAGTGCT AGATCAATTA GGTGTCGAGA GTGTAGAAT CAGAAATCTA GATGATTTTC	1500
AGCAAGATCA GAGTGACTTG TCGGGTTGA TTTGCTG TGGTGAGTCT ACAACCATGG	1560
GCAAGCTCTT ACGTGACCAG AACATGCTAC TTCCCATCCG AGAAGCCATT CTATCTGGCT	1620
TACCAGTGTT TGGGACCTGT GCGGGCTTAA TTTGCTGGC TAAGGAAATC ACTTCTCAGA	1680
AAGAGAGTCA TCTAGGAAT ATGGATATGG TGGTCGAGCG TAATGCTTAT GGGCGCCAAT	1740
TAGGAAGTTT CTACACGAA GCAGAATGTA AGGGAGTTGG CAAGATTCCA ATGACCTTTA	1800
TCCGTGCTCC GATTATCAGT AGTGTGGTG AGGGTGTAGA AATTTTAGCA ACAGTGAACA	1860
ATCAAATTGT TGCAGCCCAA GAAAAAATA TGTGGTAAG TTCTTTTCAT CCAGAATTGA	1920
CTGATGATGT GCGCTTGAC CAGTACTTTA TCAATATGTG TAAAGAAAA AGTTGAGATT	1980
GAATTTCTCA ACTTTTTTAC ATGTAATAAA CAATAGCGAT GTATTGAAGT GCGGACGCAG	2040

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CTAGGATAAA GAGATGCCAA ATCATGTGGA AATAAGGTTT TTTCTTGGCA TAAAATCCAG	2100
CTCCAACGTG ATAACAGAGT CCGCCAGTTA CCATGAGACT CCAGAAAACG GGTGTCGTTT	2160
GACTGATAAT GGCAGGAATG ATAGCCAGAA CCAACCAGCC CATAATCAGG TAAAGAGCAA	2220
GGCTAAATTT CTCATTGACC TTTTGTAGCA AGATTTTATA GAGAATACCA AAGATGGTCG	2280
TTCCCCATG GATGACAATA ATCAGATAGC CAAACCAGTT ATTCATCAAG GTCAAGACAA	2340
CGGGCGTGTA TGAGCCGGCA ATGGCAACGT AAATCATAGA ATGGTCAATG ATTCGCAAAA	2400
CATATTTGTG GGTGCAACCA TAGGCCATAG AGTGATAAAT GGTGGATGAT AGGAACATGA	2460
GAAAGAGACT GATGACGAAA ATGGAAACGC CGATAGAGGA TAAAATCCG TGTGCTTCAT	2520
AACTATAGAT GGATGAAATA GGCAGCAAGA TAAGCATGAT GACTGCACCC ACAGCATGGG	2580
TCACGCTATT AGCAATCTCC TCTCCAAAAC TGAGTTGTTT GCTGAGTTTA AGACTAGTGT	2640
TCATGGAATT ACCTCCTCTT GAGTATGATC GATTAAGTCT AGAGTTTGAT GATAGAGTTT	2700
AACGGTTTGG CAGCTGGTTT GGATAATAGG GTTAGCTGGG TCAATTCCTT GGTTTCATGTA	2760
GTCCACAAAA GCATCGTAGA GTTGGTCTGA ACTTGCTTGA GTTTGTAGAG TATTAAGTGT	2820
CTGGGCTATT TCTTGAATAG AAAATACAGA CTTGAGGGTT GTGATAGCAA TCAAACGGGC	2880
AATCTGTTGG CGTTGGTATT TTTTTTGTG AGGCTTTGTC AGGTAACCAT TTTTCACATA	2940
ATTGTTGACC ATAGATGCTG TTAGGCCCTT GTCTTTATTA GGAGAGATAG GGGCGCAGAC	3000
CTGATTGACA	3010

## (2) INFORMATION FOR SEQ ID NO: 26:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 15213 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO: 26:

CATAAATCGG TGCAAATAAC TTAATAGTGA AGTAGCCATT TCTTTCGTAT TTACCTGAGG	60
CATATTCCTT AGACGAAAGA ATATTATTAT CAATCAAATC ATTGAATGAA CGTAGTCTTT	120
CAACTTCTTC TACTGTTAGA TTTCTGACAA CATTGTGTC ATAGACCTTA TTTCCATCAG	180
GATCAGGATG GTAATCATTT GTAACCTTTC TAAGAAGTTG TTGTTTTTGA TTCGTATCCA	240
ATTTAAGAAT TGAATTCCT TCGAGATATT CCAACATATA AACACGTCA AACATGTTGT	300
GGACATATTG CTTCAAATCA TCTGCATTAT TAAATCTTGT AGTTGGATCA AGTACTTGTA	360
ATCGTCGACT TTCTGTACTA TCAGATTTTG AATGTTTCAA GATGGAGTTG ATGGTAATGG	420



TCGCATCATC TGGATGGTCT GGTGCTTGTA ATAATCCTTT AGCAAAGAAC TCTGGTCCCA	480
AGCCACTTCT TCGACCATAT CCTCCAAGAT AAATGTCCCTG ATCTGAGTCA TGTGTCATCT	540
CATGCGTATA AGTAATAGCT CCATCCTTAT CCAACATTCG ATAACCCATA TAATAAAGTG	600
CATCACCTGT AGCATAAGCA CCGTGTGAT TATGCCCAAC TTTATTTCCA ACAGGTCCAA	660
AGAAATGTTG CATTGCAGGA TTTGATTAT CAAAATCTGC CACTTCTGTA GCTTTCCCTA	720
CGGTATTATC ATGCCCAAAT TTATAAGCAT CGTAAAGCAA AATATTTCTA TAAAGTTTTT	780
CACGTGCATT GTCGTCTAAA ATACGATACC AATAATCGTA GTGATCTCGC TGACGTTTGG	840
CTGTTTCACG CGCATTTTCT TCAACAAAAT CATTGAGAGC CTTGCCCGCT TTATGGTCAC	900
TACTGCGGTA GCGATCATAA GCTCCAAATC CTAGACTAGA CATGGTCGAG ATGACAAATA	960
CGGATCTCTC TGGCAAGGTC AGGAGAGGCA AGACCATATT GCGGTATTTT CATGTGGCAC	1020
TCGTGATACG ATCATAAACA CCGATAGAAT ACTTGGTGCC AGCTAACCCT TGCTTCGTTT	1080
TCACCTCTTC GATAGTGGAT TTTTCTTCGA CAATGTAAGC CTTAGTCTCT GATTTAAACC	1140
AGTCATTATT GCTTGATTTT GGTAAAAAGA CTTTTCGGTA ATGTTCCAGC GTGCTAAACA	1200
AATCTGTCGT TCCATGTTGA CTGGCAAGAC TGATACCATA AGTATCGACA TTATCTTAG	1260
CTAGAAGATT GTTAAAGCCA GATTTACCCA ACTCAATCAG AGTATCTAAT GGTGAAGCAT	1320
TCCCCTTACC AAAGAAGTCC AAATGGTACA GAACTAGGTC TTTGACATTC ACCTGACCAT	1380
AGCTAAAGTT ATACCACCGT TCCAGATAGG TCAAGCCAAG TAGCAAGGCT TCCTTGTGTC	1440
GTTTGATTTT ATCTACAAGA TAACCTTCAG TGACGGGGTT AGCACTAGCC AGTCCAGCAT	1500
CCGCTGACAA GAGTTTTTTC AAAGTGTCTT CCAGTTGTTG TTTTGTTTTG GCGAACTGGT	1560
CTTCTAGATA GAGCTCAGTT TGCTTGACGT TTGGAGAAAT ACCCAGCGTC TTTCTGATGG	1620
CTTCTGAATG ATAGTCAACC TTTTGTAAGT CAGGTAAGAC TTGCTTGATG ATAGAGGTTT	1680
GGTCATACAG GAATTGGTTT GGCCTATAGA GAAGTCCAGT ATTGCCCAGA CTATATTCTG	1740
CTAATTTGGC GAAATCATTC TGGTATTTGA GATCCAGCTT CTCAGATAAA TCATCCTTGT	1800
AGTGAAGCAA GAGTTTGTTC GCAGTCTGTT TGTTAGAAAC AATGTCTGTG ATGACTGGT	1860
TGTCCTTCAT CATGACTGCT GACAAGAGTT CTTTTTGATA TAAAAGACTG TTCTCATTGA	1920
CCAGGTTTCC GTATTTGACG ATGGTTGCCT TGTGTAGAA AGGTAGCAAT TTTTCAATGT	1980
TTTTATAAGT CAAGTTGCGC TTAGCTTGAT AATAGGCCAC CTTAGAAAAA TCACTGTCTT	2040
TTTGTCCACT TGTGAAAGT GGCTCCACTG TTGGTAAAAT GAGAGGATTG ATTTCTGCTT	2100
TTTTGCTTGC AATTGAGAA GCATCTAGCA TTGTTCTCTT TTCTTCAAAG GATTCTTGC	2160

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TGACGACCTC ATCCTTGACC AAGGTGACAT TGTAGACTCT GTTGGCCTTG CTGCTGAATG	2220
TGTCCTTTAC CTTCAATTCG TTATAGTGGT AACCAGTGAT GGCATTTCCG TTGGTTACAT	2280
TAACATCGCT GAGAACATTG GTCAAACCTC CAGCATGCCT AACATCACCA GAAGTTCGAT	2340
CCCACAAATT GCCTGCCACT CCAGCGACTC TACCAAAGTG CTTGACATTG TTGATATCAC	2400
CTTCAGCATA GCTATCTTGG ATCTGTGCAT CTCGGTCTAC TAGGCCTGCA AGTCCACCCA	2460
CAGTCTGATC TGAAGTATTT GTGTTAGATG AAATGGCTAC TGTGCTTTT GACTTAGTAA	2520
GTAAAGCCTT GTCACCTGTC AAATGACCGA CCATACCACC GATATTGTAG GCAGCAGTCG	2580
TTTCATAAGT GTTGATAATT CTTCCCTTGA AACTGCTCTC TGTGATGCTT GATTGCTCAG	2640
CCTTAGCCAG CAAACCACCG ATACCACGTT CACCAGCCAG AACACCATCG ACGTGAACCT	2700
GCTTAATTTT TGTGTTATTC TGAGCTTCAT TTGCCAGTGA ACCGATATCA TCTTTCCCTG	2760
AAATAGCAAC ATTTTTTAGA CTCAGTTTTT CTACTGTAGC ACCACTCAAG TTTTCAAACA	2820
GAGGTTTTTT CAAATATATAG ATAGCATAAT TCTTGCCATC TTTTTCACCG ATTAAACGAC	2880
CAGTAAAGGT GTCCCTTGATA TAGGATCTTT CATCAGGACC AAGCTCCACT TCGTTAGCAT	2940
TCAGGCTGGC CGCTAAATGA TAGGTTCCAG AGGGATTTTG GTTTATAGCT TTGACCAGAT	3000
TACTAAAGGA AGTAAAGTTT GTTGTTCCTT CTGTTCCCTT CTTAGCTAGA TAGAAGGTAA	3060
AATTATCTTT ATATCTGCTT TCTATCTCCT GCTGAAGCTT CTCTACTTTT GCTGTGATTT	3120
TATAAAGGAT TTTATCATTT TTCTTTCCT CTGATATTGA TGCTACTGGT AGGTATACAT	3180
CTTTGAATGA AGAAGATTTT ACTTTAACAA AGTAGCTATT TGGATTGCTT GGAACCTGCT	3240
CTAACGAAAT GTGTGTTTAA TAAGTACCAT TTGACAACT GTATAACTCT AGGTCGGAAA	3300
CATTTCTTAA TTCAAGTGTT TTCTCTGGTT CTTCTACCTT TTTATCAGGG TCTAGTTCAT	3360
TTTCTGTGTT AATTTCTTCG TTTCATTG AATTGGATGT GTTTGATTG GTTGAAACAT	3420
CCTCAGTTGA ATTTCCGTTT GATGGTTCTG GTTCTGTTTG TCCATTCTCT GATGTTGTAT	3480
TACCTGAATT TTCTGGTTTT GTTGCACTC CGTTTTTTTC TGGTTGATTT GATTCTTCAA	3540
CTGGTGGTTT TGAATCACTA GGTTTATTGG ATACTTCTCC AGTATTTTCG TTAGCTATTT	3600
TCCCAGAGTT TGTTTGTGTT TCTTCTGCAG GTTGAACCTG TTTTCTGTT TCTTGATTG	3660
AGGTACCTTC TACTGTGCCT TCATTGGAT TTACTGGAAC TTCTTCTACA GTTTTTTCTG	3720
AATTTTCATT TTTAGAGTCA TTATGTTCTG GTTTATTTGA TTCTCCAAC GAGGTTGTCG	3780
AATCACTAGG ATTACTGGAC ACTTCCCAG TATTTTGTCT AGATGTATCT GGTGATACTT	3840
TCTCTGAATT CGTTGTTGAT TCTTCTGCAG GTTGAACCTG ATTTTCTGCT TCTTGAATTG	3900
AGGTTCCCTC TGTAGTACCT TCATTTGGAT TTACTGGTGT TTCTTCTGTT GGTTTTACTG	3960

GAAGTCTCTC	AGTTTTCTCT	GGACCTTGTT	CTTTGGTCTT	CTCAACCGGA	GTTTCAGGTT	4020
TTACTTGCTC	AATATTACCC	TTATATTCTG	GAAGCGGTGC	TACCTGCTCT	GGTTCACCTT	4080
TATCACTTAC	CACAGTATCT	GGCGACTCTG	GTTGAACCTC	AGTCTCACCT	TTGTCGGTCA	4140
CAACTGCTTC	GGGTAATGTA	GGTTGAACCT	CTGGTTCGCC	TTGTCACTT	ACTACAGCTT	4200
CGGGCAACTC	AGGCTGAATT	CGGGGTTCAG	CAATAGCTCC	AGACTGTACG	TCCTTATGTT	4260
CTACACCAGT	CTCAGGTTGT	TCCTTTATAA	CTTGAGTTT	TTTAGTACCT	TTTTCGACTA	4320
TTCTTGGACT	AGGCGCAGTC	GTTGAAGTTG	AAACAATTTC	TCGCGAAACT	TCTTCCTTGT	4380
TTACAGAGAA	TATTCTGACG	ATTTCACCTT	TCTTACCTAA	TTTACCTTCT	TGTTTACTTC	4440
TTACAGTTCC	TTCAGCTAAA	TCAGGATTTT	CTTGAATTTC	TTCTTGAAAA	TCTATTTTGT	4500
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CATCCTGTGG	ATTTAATGTA	TTTACCCAG	TCTTTCTTTT	TGGAGAAATC	TTCTCCTCTT	4620
TCTTCGTTTC	TAGATTCTTA	TGTTCCGCTA	ATTGTTCTTG	AGAATCTGAA	GATGTTTCTT	4680
CTTCTTTTCT	TGGATTGATT	AATTCAGTAG	AGAAAGGTTT	TTCAACTACT	TGAACTTCTG	4740
TCGGCTTAGT	TGAAGAAACA	GGTGTGTT	CCTGAATAGC	TTGTACTGTT	GATGGATGGT	4800
CTACAAAATT	CGGTGTAACA	TTATAATCCA	CCTTTTGTG	TTTGTAGGA	GTGGCAACTG	4860
AACTCTTTTG	ATTACTTACT	TCAGACTCAG	AAGTCGTTTT	TCCCTCTTTG	ATATATCCAA	4920
TATAAGTGTA	ACCTGAAATC	TCTTTAGGAA	GAGGTAATTT	TTCTCCAGAG	GTCAATTCAT	4980
AGTCCGTATT	GTAATTTAGC	AAAAGATGAT	TTTCTAAAGC	ATGGACTGAA	ACTAAGACAC	5040
CATTTCTTAT	CCCTGCAACC	AATACTAAAT	GTAATACCGT	TTTATTCTTA	ACCTTTTCTT	5100
TGGAAACAGC	AAAAATTAAA	ATTCCCATAG	CAGCTAAGCT	AGCACCAGCA	ACTAGGGCTT	5160
GCCTCTCATT	CTTGCTTCCA	GTATTTGGCA	ATTCCGCCAG	TTGATTTTGA	GAATTTAACT	5220
TATAACAAG	ATAATAAGTT	TCATCATCAT	TCTCCACGTA	TGTCGGAATA	TCATAGACAA	5280
GCTGCTTCTT	TTCTTCTGAT	GATAGCTCTG	AATCTGCCAC	ATATTTATAG	TGAACTCCCG	5340
CAGTTTCTTG	AGCATCCACA	GATGAAC TAG	CTAATACAGA	CATAAAAAAT	AAACTTGAAA	5400
TCGTTGCAGA	TACAAGTCCT	ACTGATAATT	TTCTAAATGA	AAAACGCTCT	TGTTTTTCAC	5460
CAAATACTTT	TTCCATTATT	CCTCCTTGAA	ATAAAATTTA	TATATGTTAC	AAAGACCTTT	5520
ATTATATTAG	TGTATTATCT	ATTATCTATA	GAAAAGGCAG	TATACCTTAA	TTATACTCTT	5580
AATTTACAAA	AAAGCTTAA	AATTGAGATG	CGCTTTCATA	CTTTGTTTTA	TATTATTTGG	5640
AGGTACAATA	ACACCTACCA	TGAAATTTAC	ACGGTAGGTG	TTACTCATAT	CACTAATCGT	5700

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GAGCGATGGT	CTTCCTGCAG	GCTTTTTTTT	AGAAAAATCTC	GGACTTGTTC	TGGTGCGATT	5820
TCAAATTCAA	AGGCTTTTCAT	TTTATAGAAA	AAGTCGATGA	GATGATCTGA	CAGGTATTCA	5880
GTTGAAAAGG	GTACTTCACC	ACTTTTTCTA	TATTCTAATA	AGAGTCTAGA	AAATCGAGCT	5940
TTTTCTTCAG	GAAGCTCACG	AAAATAGGAA	TTGAGGATCC	AAGTCTGCCT	CTGTTTTCTT	6000
TCAATTGGAT	CCTGACTGGC	AATTCGTTGG	TCTTTTTCCA	GCTCTTTTGG	GTATTGTTTG	6060
GCCTTGATAG	CTCGTTCTGC	TCTATTTTAA	CCAAAAAGAA	TTTTTTCCCA	CTTGCCTTCT	6120
TCTTGAGTCA	GGGTCTCTGT	AAAGCCAAAG	TAATCTTGAT	AAGCACGCCTC	TGCGGGTCCC	6180
ATGGCTAGAA	CCAGATTGTC	TGCATATTGC	TTGGCGATT	TATCCCTCTT	CTTGCCTTCT	6240
TTCTCTGCCT	GGATACGGAG	TTCTTGTTTCG	TAGTCAATTT	TCTCCTTGCC	TAGCTTGACA	6300
AGGTAGAGTT	GGTCATCCGA	TTTCCCAAGT	AAAAGGGTT	TGATACACTT	TTCAGGACT	6360
TCTTCCATCC	GAGCCTTTTT	CTTTGGTTCC	GCCTTGGTCC	AACTTCCTCC	CTGAAAGACT	6420
TCTAGGAAAA	GCTGGTAGTC	TCTCTCAGGC	GCAAATTGAT	TGCCACGATT	GGGTTTGAAA	6480
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ATTTTTTCTT	TTTTCTGAGC	TTTTCTGGTT	AGATTTTCAA	CCTTTCTGAG	CAGTTTTTCT	6600
TCCTCTTCCA	ATTGCTGGTC	AAGGGACAAT	CGATGAAAT	GACGAACACA	GTCGCTACCA	6660
ATTGGAAGA	GGCGTTGGCC	TGTGACACCG	TTAAGAGTT	CATAAGCGTA	TTTGATGGCA	6720
TTCCACAGA	CACAATTGCT	ACGGCCGATA	CCGTAAAAA	TAAAGGAAAC	TTCATTCCAT	6780
TCCTTGGTAG	CTTGTTCCCA	AGTATCCGCT	TTCGAAGCCT	GTAAACTGTC	ATCGTGCAGG	6840
GATTTTCTAA	CTGGAAGTGT	CATGAGGTCT	CCTTTCTAAT	ACTCAATAAA	AATCAAAGAG	6900
CAAACCTAGAA	AGCTAGCCGC	AATCAGCTCA	AAACACTGTT	TTGAGGTTGT	AGATAGAACT	6960
GACGAAGTCA	GCTCAAAACA	CTGTTTGTAG	GTTGTGGATA	GAACCTGACGA	AGTCAGTAAC	7020
CATATATACA	GCAAGGCGAA	GCTGACGTGG	TTTGAAGAGA	TTTTCAAAGA	GTATAAGTTA	7080
TACTTTTACA	ACTTGAACCT	CGTCTTTACC	GAGTAAATC	AAGTATTTTT	CAATATTTTC	7140
AATCGAATAG	GCTCGTGATA	AAGCCTCTTC	GTATAGAGCT	AACTGACCAC	GATAGCGGTC	7200
TACGAGTTGA	CTTGGTTCAT	CATAGCGGTC	TGTCTTGTAG	TCGAACAGAA	CAATTTTGT	7260
TTCTGTAAGC	AGATAGCCAT	CAAGGATACC	ACGGACAACA	AAGTCTTCCT	GACTCTTTTG	7320
GTCTCGTTTG	AGCATGGAGA	AAGGTTGCTC	GCGATAAAGA	TGGTCGGTAT	TAGCAAGAAT	7380
TTCTTGACCG	AGTACTGTGT	CAAAGAAAGC	AAGAATTTTA	TCAAGATTGA	TCTTGTCTCT	7440
GACAGCTTGG	CTAGTTTGAA	CTTGTTTGAG	TGTTTCTGTT	AGGCTAGCAA	GGGTTAGTTC	7500

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CTGGCTGAGG TCAATCTCT GCATGAGTTC GTGAGTAGCA CTACCAATCT CAGCTCCAGT	7560
TACCTTTTCT TTGGTTGAAA AATCTGGCAA ATCGAAGCTG ATTTTCTTGC CTACTGACTG	7620
ACCTTGACCA GCAATCTCGA CACCTTCCAT ATCCATAACT GGTTCGTAGA ATTTCTTGAT	7680
TTGACTTGGG GTTTGAACAC TAGGAAGTTC AATAGCTGCG CGGTGAAGAG TATTATAAAC	7740
TTCCACCTCC TTCAGCATTT CCAGAGCTTC TTTGATGGTA TCTGACTGAC GATTGTCTGC	7800
TTGGGAGCTA TCTTGAGAG GACTCTTGGT TTCCAACCTCT CCGATAGCTT CTCTGGTCAA	7860
CTGATCTTCG CCAATAAAAC GATAACTAAA GTTGAGCTTG TCCTTAGTAA ACACTTACT	7920
GATAGCCCAA AGCCAATCTT GGAAATCCG TGCTTGCACT CTAGTATTGC TATTTAGTTT	7980
CCCATTTTGT GCTGCTGGGT ATTCTTGGT TTCCAGCTTT TCACGAGAAC CCTTGCCGAC	8040
AAGATAGAGC TTTTCTCAG CCCGCGTCAT AGCAACATAC AGCAAACGCA TCTGCTCAGA	8100
ATAGCTTGCT AGCTGTAATT CCTCTTCGTT CTGCCTATAG GTCAGACTAG GAATGGAGAG	8160
TTTGATGGTT TTAGGATAGT GGTCTTCTAC TGCCCTGTC TCCATCTTGG CAATATATTT	8220
GACACCAAGA CCATTCTGAC GACTGAGAAT GACTTCTGAC ATAGAGTCTT GCTTGTGAA	8280
ATCTTGATCC ATATTGAGGA TAAAGACGTA AGGAACTCC AGCCCTTTAC TCTTGTGGAT	8340
GGTCATGAGC TCTACTGCAT CTTTGGCGG TCGGACGGCC ACGCTTGCCA AATCGTGCTG	8400
GGCTTCTAAG ACTTGGTCAA TCATACGAAT AAAACGCGAC AAACCTTTGA AATTGCTCTT	8460
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ATAGAGAGAG TGGGTTTTGG CATAACAAGC CCAAGAAGCT AGGATATCCA TGAATTGCTT	8640
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ACGTGCTAGC TCATCCTCAT CAAAACCAA CATTTGGAGAC TTCATAAGGG CAACCAAGGC	8820
GTAGTCTTGC AGGGGATTGT GAATGACACG AAGAGTGTCT AGCATGACTT GCACTTCTAG	8880
GGATTGGAGA TAATTGTTTT GCTCTCCGTC AGTTTTGACA GGAATCCGT ACTCAGACAG	8940
GGCGAGGAGA ATCTGGTCAT TACGACTGCG GCTGGAGGTC AGAAGGGCAA TTCTCTTAAA	9000
GGCAACACCT TTTTCTTGAT GAAGTTTCAG AATCTCCTTG ATAAC TAAGC GCATTTCGCC	9060
TGTTAGTTTC GTTCTGTTT GACTCTCTTC TTCCTCACCT GTATCGTCCT TGTCGTAGAG	9120
GAGAAATGCT GCCTTGTTGT CTGGATTGGG AGTCAGTTTG GTATTGGCAA AAACAAGCTG	9180
GTGCTTGTTA TCATAGTTGA TTTCGCCGAC CTCTTGGTCC ATGAGACGTT CAAAGACATC	9240

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ATTGGTTGCT GACAGCACTT CTGAACTACT ACGGAAATTT TCCTTGAGGA TAATGAGCCT	9300
GCCTTCTTGG GGATTTTGCG CATAGCGTTG GAATTTCTCA TTGAAAATCT GCGGGTCTGC	9360
CTGACGGAAA CGATAGATGG ATTGCTTGAT ATCTCCCACC ATAAAGCGAT TGTGGCCATT	9420
AGACAACAAT TCCAGCATCC GTTCTTGAAT ATGGTTGGTA TCCTGATACT CATCGACCAT	9480
GACTTCATGG AAGCGCTCCT GATAAGACTC ACGAACTTGT GGGAAATCTCT CTAAAATCTC	9540
AATGGTGTA TGGCTGATAT CAGCGAATTC GAAGGCATTT TCCTGTCGTT TTCTCTGACG	9600
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CGGCTGGCAT TAGTCAGAGC TCGACCGTTT TTCTCCTTAG AGATGGCGAC AACACGCGCA	9840
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TGGTAACGGA AAAAGCTTTC CAAATCCCAA AGGGCTTGTT TGATTTGCTC GGTCAGTTT	10020
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TTTGTAGGAT TACTGGTGGA TTGGAGGAAG TCATAGATTT TATAGACCTG CTGGCGCAGA	10140
CCCCGTTCGT CCTTGCCAGC CCCAGCAAAG TTTTTCAGCA AATGACTAAA GGTCTCTTTC	10200
TGTTTACCTT GGTAAATGCGC TTCAAAGACC TCATGAAAGA CTTCTGTTTC GAGAATAAGT	10260
TGCTCGCTTT GGTTTTGTA AATACGGAAA TTAGGTGCAA TATCAAGCAG ATAACCATGT	10320
TTGCCAAGGA ATTTTGTGT GAAAGAATCC ATGGTTCCAA TGGCAGCGTT GGGTAGGTCT	10380
GCCAACTGGC GACCCAAGTG TTGTTTGAGG TCGACATCAT CTGTTTCTTG GATTTTCTTG	10440
CTGATTTTTT TCTCTAAACG TTCTTTAAGT TCAGTTGCAG CCTTGACGGT AAAGGTTGAG	10500
ATAAAGAGTT GAGAAATTTT GACACCACGC GCCAATGGT CCAGAATGCG CTCTGCCATG	10560
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TGCAGTTTTT GAATCTCTC CTCACCTAAA AAGGGAATAA GCTTCATCGA TTCAACTCCT	10740
CTCTTATTTT TTCAAGCCAA GCTTGCTTGA GTTTTCTCC GACCAGACGC TTGCCATCAG	10800
CTAGGTCCAA CTTTTCTAGG AAACGGGCTT GGCCAGATG GTAATTGGCT TCAAAGCCTG	10860
TAATAGCCTG ATGTTGCTGG ACGTATGGG CAATGCTTCT GCCATTTTCA GTATAAGGAT	10920
TGATGGCGAA CCGGCCTGCT AAAATCTTCT CAGCAGCTTT CTTGTAAAGA TAGGCATTGT	10980
AGTCCAGTAG GAGCTGAAAT TCCTCATCTG TCAGTTGATT AGCCTTGTTT TTGTTATAAA	11040

ATTCGCCTAA ATAACCTGCTT TCTTTTCCCA AGAAGAGCCC TTGGTATTTT ATAGATTTGC	11100
TGGCTTCTAC CACTGCTCCT GCCAGACTTT TTACCGCCAT CAGAGATTGG ACAGGTTTCAG	11160
CCATTTCCAA GTACATGGCG CCGAAAAAGT TCTGCTCCCC TTCTCTTTTT AGGGCAGCAA	11220
GATAGGTTGG TAACTGAGAA TTGAGCCCAT TAAAGAAATG AGGAACTGG AACTGAGTCA	11280
GACTGGATTT GTAGTCTACT ACTCCTATCG CTCATTAGC TTCAAACGG TCAATCCGGT	11340
CCACCTTGCC TCGTACAAAG ACACTGCGTC CATTGTCTAA TTGAATAAAG GCTTGGTCTT	11400
TTCCACCAAA ATTTGCTTCT TCTTTGATGG TTTCGATGGC TGGATTGTGT CGGAGAATAT	11460
GTCCAGTTGT CCGTGCAACA TCAAGCAAAA CTTCCTTGGT AAAGTGGGCT TCACAACTTT	11520
CTTGATAAAT AGCTTCAAAT TCGCGTTCTT GACTGGTTTC TTGAATAGCT TGTCTAGAC	11580
GTTCGTCAA GGAATCTTCA TTAGGCAACT GTAAGGCGCG TTCAAAGATA CGATGCAAGA	11640
AATTCCTGTG ACTACGGGCA TCAGGATGCA AACGTAATTC CTCCTGCAAG CCTAAAACGT	11700
AGCGTAGGAA ATAACCTGTAT TCATTGCGAT AAAACTCTGT CAAACCCGAC GTAGACAGGT	11760
AAAACCTCTG TTTGGCAGGA TAGAGAGCTT GCAAGGTGTC CTTGGCTAAG GTCTTGCTGC	11820
TTGGACTGGT TGGGATAGCT GGATTTTCCA GACCTTGCTG ATCTAGTTTT TTACCTATGA	11880
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GGTGATAGGC AACGAGACTA GACAAAAGAC TGTGATAGGA CCCCATATCC TCCTTAGACA	12000
GTCTTTGTG ATTCATCTC TTCTCTCTCC GCCTAAATCC AAAATGGATC AACTCTTGAA	12060
GATAGGCAGA TTCTTACTT TCACTTTCGT TAAAAAGGCT TGGAGCCGAC AAGAACAAC	12120
GCTTACGAGC AGAATTGACC AAGGAAAGCA TAGGTAGCG ATTTTCTTG AGATTTTAC	12180
TGCTGGCAAT CAGTAATTGA ACGCCTTCTT CGGTCGCTG GTTTAGGTTT TGCCTTTCTT	12240
CATCTGTCAG AAGACTGGTG TTTTGAGAAA TTTTGGTAA ATTGTCCTGA GTTAGTCCAA	12300
TAGCATAGAC AAAGTCAGCA GTCAATGGTG CAATCAAATC GTAACCTGTC ACCAGAACAG	12360
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CTAGGAAGTC TTCCAGACTA ACCTGTGAAC CAGCAAAAAC AGTCGCAAT TGTCTAAAA	12480
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TTGTCAAATC TTGTAAGTC TTGGTCACAG CTCCTTCTTT TAGAAAGACA CTCCATTTT	12600
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TTCTCAGGCG GAGGACATTC AAACGCTCAA GATTAAATTT TCCATGGTGG GATTTGGTGA	12720
AGGTTTGCTG AAAGGCTGGC AAGCCATTGA TACCAAGATA GCGGATATAT TGCTCAAAAG	12780

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CATCAATATC	AGACTGACTG	AGGTCAGTAT	ACAAATCAGT	TCTAAGAAGA	TTAATCAAAT	12840
CCTCCTGACG	AAAACGGTAA	CGTTTAAAG	CTAAAATAGA	CTCGACAAAC	TGAGTCAAGG	12900
GATGATGAGC	CATGGCTTCG	CTTCTACCAA	GATAAAAAGG	AATCTGATAC	TGGTCAAAAA	12960
TGGTTTGTAG	AGATAACTGG	TAAGAAGCTA	CATCCCCCAA	GAGAATACGA	AAATGCTTGT	13020
AGCTCAGGTC	TGAGTTCTCA	TGTAATTTCT	GACGAATACT	ACGGGCTACT	AGCTCCAAC	13080
CCTCCTTTTG	CGTCAAACAA	GACCAGATTT	GTAAATTTTC	ACGGTCTTTC	TCATCGACAT	13140
CCAAAGCGAG	TTCTGAAAAG	TCATAAGAAG	ACTCCAACAA	ACGAGAGGCC	TTGTCAAAAC	13200
TATCCATCTT	CTCATGAGTT	TGAGAACAGT	CCTGAGCAGG	CGTTTGGTAT	TTAGAAGCCA	13260
GATGATGGAG	AAATTTTACG	CTGGCTTGGT	AGAGATTGCC	CTCGCTAAAA	GGACTGGTAT	13320
AGGCTTTCTT	ACTAGCATAA	GCCCCGATAA	CAATCTCAAC	ACCTTTGCCG	TGAAGTAAGT	13380
CCACAACCCG	CTCTTCCTCA	GCAGAAAAC	GAGTAAAGCC	GTCAATGACC	AAGGCGATTT	13440
GATTAATAATC	ACTACTTACC	TTGTCAATTCT	CAATAGCCTC	AATCAAATGG	GACAACTGAC	13500
TTTCCTGGGC	TAATGACCT	TGATTAAGAT	AGGCTGTAC	TTTCTCAAAA	ATCAAGAGTA	13560
AATCCGCCCT	CTTATCCTCA	TCTGTAAAT	TCTCCAAGTC	CAAAAACTC	ATCTGAGATT	13620
TGGTCATCTC	ATGGTAAAGC	TCAATTAAC	GCTGGATCAA	TTGAGGATCC	TGCTTAATAG	13680
CGCCATAAAC	ACGCAAGTCC	TTGGGATCGA	GTTTCGCAAG	GCATTTGTAA	AAGGCCAACC	13740
CAAGACCGAT	ATCATCAAGA	GTAGTTTAG	CTGGTAAATC	ATTCAAGACC	AGATAGCGAG	13800
CCATTTGAGC	AAAGCGCGTG	ACGGTAATCG	AAAAAGAAGC	CTGCTGGGAC	AAGTATTCCA	13860
GCACGGCGCG	TTCTTTTCA	AAAGAAAGAG	AGTTGGGGGC	AATGTAGAAG	ACCCGCTTGC	13920
CAGCTGCAAC	TAGCTCTTCT	GCCTCTCTTG	TTAGAATTTT	TGTCAAAGAA	GTCCGAATAT	13980
CAGTATAAAG	TAATTTTATC	TCAGCCTCGT	TGGAATTTT	CATCACCTTA	TATTATACCA	14040
TGATTAGCCT	CGTAAATCTG	TTAAATATT	TAGGCCATCC	TTTCTTTTCT	TCATCATCTG	14100
CTAAATCTTA	AATACTTAGC	TTTACTTGTA	TTAGATAGAA	TAAGTCTGGC	TACTGAAAT	14160
CACATAATAA	AAAAGCCTCG	GTAACAAGGC	TTTGAGTTT	ATGATTGTTT	CTTAGGTACG	14220
GAATACACTT	CAATGTGTG	TCCCAGTATC	TTAATGTGCA	CTGGTAGATT	GTCTGATTTA	14280
TCGCCATCAA	CATCGGACTC	TAATTCGATA	TCAGAAGAAG	TTTAAATATT	ACGTGCCTTT	14340
ATATATTCAA	TATTCTTGAT	AGAATGATTG	AACTATAGTA	AATTGAAACT	ATAATAGTAC	14400
ACCGTGGATG	CTAAATATT	TCTAGAAATT	AATTTGATTT	CCCTAATCAA	GCTATTCGTA	14460
TCTTATTTC	ATCTACTATA	ATAAAATGAA	CCAAAAATAG	TACACAATGT	GGTATAATCT	14520
TCTTATGGCA	TATTCAATAG	ATTTTCGTAA	AAAAGTTCTC	TCTTATTGTG	AGCGAACAGG	14580



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TAGTATAACA GAAGCATCAC ACGTTTTC	14640
AAAGCTAAAA GAGAAAACAG GAGAGCTAAA	14700
AGTTGATAGA GATAGACTTA AAAACTATCT	14760
AATAGCTTCT GACTTTGGCT GTCATCCAAC	14820
CTACACTCGA AAAAAAGAAC CACACCTACT	14880
TTCTTAAGAA TTTTAATAGT TTAAAGCACC	14940
TCGATACTTA TTTTATCGA GAATATGGTC	15000
AAGTATCTGG AAGAAGATAT CAGAGGATTT	15060
TAATCGCTCC AATGACTTAC GAAGAGACGA	15120
AGAAGTTTCT CTTACCAACA TTAACCACAC	15180
ATAGGGGGGG GGGGGGAGGG GGGGGGAGGG	15213

(2) INFORMATION FOR SEQ ID NO: 27:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 6004 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 27:

TTATTACCTG AACATTAAA TTTAATTGGA	60
AGATTTTAT TATCTGATTC AGGAATTTTA	120
TTCATTAAAT TATTTGATTC ACTAACATTA	180
TGTTATCGG AATCTAAATA CGATGAGTTT	240
CCACCAGGAA TATATCTCAC TACTAAATTC	300
ATAACAAACT CTAGAATATA TTTAGTAGT	360
TGATACACAT CACCTAATTC AAAAAATGCA	420
ACCTTTTCTC CGTTTTTCAC TAAAAGTTTC	480
TGTGTAGAAT GTGTAGTGAT AATAATTTGA	540
AACTCTTTAA ATTTATAGAT TGCACTCGGA	600
ATTAATGAAT TTGATTGCGC ATTTACTATA	660
CCTGTTCTCTG CAAAAGCCTC GGAATATTCT	720

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GAAGCTTTTA TATCATCACC TTTTGAATAC AACTTATGTG TTAAAATTTG AATGTCGTGA	780
TAAGATTTCAT CCATTATTTT ACTAATAATT TCACAACTT TATCATCAAC TTAAACATTA	840
TCTATAACCA TTTCTTTTTT ATAACGCGTA TAGCTACTTG TATTATCTTT TAAATATCA	900
GCAACTGGCT TAGATCGTAA TCTTATAAAA TCTTGTTTAC TACGTTGAGT AGAAATTTTT	960
TTAAAATTAT AGTGATAGAA AAATAAATCA AAAGCAGAAA CATATTCTTT ACAATCACAA	1020
AAGACAACAT TTTTTTCAAT GCCATCCCAT CTGCTGTGCG AAGAACTTCC AATATATTTA	1080
TTTTTGGGTA ATCTTTCCAT CTCATATTGT TTTTGAGGAG CATATGGTTC CCAATAATCT	1140
AATCCTTTTT TTGTTCCAGA ACGGCCTTTA AGAACTTCTA CATTTCTAGA AGCTTTAATG	1200
TTATAATATG AATAGATTAA ACATTGTTTC CCATCCACTT CATCTATTTG ATCAACATTT	1260
GTACTAAACC AATATTCAGA CACACTTTTA TTGGCTGGAG AACCATATAA AGCTTGTA	1320
ATTGAAGTTT TATTTACTCC ATATCTATTA CAGACACCTC AGGATTATTT AACTTATAAG	1380
TTTTAACAGC TACGGAATCA ATTTCAACAG CAACTTGAAC ATCTATGCCT GATTTTTTAA	1440
GGCCACTTGT AGTGCCACCT GCACCGTTAA ATAAATCAAT AGCAACAATT TTCCCCATAG	1500
TATTCCTCTA AAGTTTCTCC TTTTATTAT AACATTATCA AATGTAAAAC CCAACCCGAT	1560
AGGGTPAGGT TTTTAACATC ATTTACACAA CTTCTTCATC TCATCAATAC GTCCGACGGT	1620
CGCGTCATAT TTAGCTTGGT AGTCAGCTTG TTTGTCGCAT TCTTTTTGGA CGACTTCTGG	1680
TTTGGCGTTG GCTACGAAGC GTTCGTTAGA GAGTTTCTTA CCAACCATGT CCAGTTCTTT	1740
TTGCCATTTA GCAAGTTCCT TGTCGAGACG GGCCAGTTCT TCTTCAACAT TGAGGAGATC	1800
GGCCAGTGGC AGGTAGATTT CTGCTCCTGT GATGACACTT GACATAGCCA GTTCAGGTGC	1860
AGGGATGGTT GATGCGATTT CCAAGTGTTT TGGATTGTGA AAGCGTTTGA TATAGTTGAC	1920
ATTGCTGTGA AAGAAGGCTT CCAAGTCGCT ATCGCTTGTG TTAACAAGGA TGGTGATAGG	1980
CTTGCTTGGT GCTACATTTA CTTCCGCACG CGCATTCGA ACAGCACGAA TCAAGTCTTT	2040
GAGACTTTC ACACCAAGTGT GAGCCGCAAG GTCTTCAAAG GCTAGATTAA CAGTTGGGTA	2100
TGCAGCTGTC ACGATAGAAC CTTCTGAGAT TTGTCCAAAG ATTTCTCTCTG TCACGAATGG	2160
CATGATTGGG TGAAGGAGAC GAAGGATCTT GTCCAGCGTA TAGAGGAGAA CAGATCGAGT	2220
AATGACCTTA TCGTCTTCAT TGTCGCTGTA TAGAACTTCC TTGGTCAACT CAACATACCA	2280
GTTGGCAAAT TCTTCCAGA TGAAGTTGTA AAGGATATGA CCAGCCACAC CAAACTCGAA	2340
CTTATCAAAG TTTTCAGTAA CTTTGCAAT GGTTCGTTG AGATTGTGGA GAATCCAGCG	2400
GTCCGTCACA TTACCAAGCCT CACCTGTTGC AACTTTTGTG ACATTGTCAT GCGCCACATC	2460
CAGCGTCAAA CCTTCATTGT TCATGAGGAT ATAGCGAGAA ATGTTCCAAA TTTTGTTAAT	2520

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AAAGTTCCAT GAAGCATCCA TTTTCTCGTA AGAGAAACGA ACGTCTTGAC CTGGTGCGGA	2580
ACCGTTTGAA AGGAACCAAC GAAGGGCATC AGCACCGTAT TTCTCGATGA CATCCATTGG	2640
GTCAATCCCG TTACCGAGAG ATTTAGACAT CTTGCGTCCT TGCTCGTCAC GGATGAGACC	2700
GTGGATAAGC ACGTTTGGGA ATGGCTGACG ACCAGTAAAT TCCAAGGACT GGAAGATCAT	2760
ACGAGACACC CAGAAGAAGA TGATGTCGTA ACCTGTTACC AAGGTTGAAG TTGGGAAATA	2820
ACGTTTAAAG TCTTCTGAGT CGACTTCAGG CCAGCCCATG GTTGAAAATG GCCAGAGGGC	2880
AGAACTGAAC CAAGTATCCA AGACGTCTTC GTCCTGAGTC CATCCGTAC CTTCTGGAGC	2940
TTCTTCGCCG ACATACATTT CACCATCAGC ATTGTACCAG GCAGGGATTT GGTGACCCCA	3000
CCAAAGCTGA CGAGAGATAA CCCAGTCGTG GACATTTTCC ATCCATTGAA GGAAGGTATC	3060
GTTGAAACGA GGTGGGTAGA ATTCGACCTT GTCCTCTGTG TCTTGGTTAG CAATGGCGTT	3120
CTTAGCCAAT TGGTCCATCT TGACGAACCA TTGAGTAGAC AAGCGTGGCT CAACTACGAC	3180
ACCTGTACGT TCTGAGTGAC CAACACTGTG GACACGTTTT TCGATTTTGA CAAGGGCACC	3240
GATTTCTTCC AACTTAGCAA CGACTGCCTT ACGAGCTTCA AAACGATCCA TGCCTGAAAA	3300
TTCAAAGCA AGCTCATTC TAGTTCCGTC GTCGTTTCATG ACGTTGACTT GTGGCAAGTT	3360
ATGACGTTGG CCAACCAAGA AGTCATTGG ATCGTGGGCA GGTGTGATTT TCACGACACC	3420
AGTACCAAGC TCAGGATCTG CGTGCTCATC TCCAACGATT GGGATGAGTT TATTAGCGAT	3480
TGGAAGGATG ACGTTTTCAC CAATCAAGTC CTTGTAGCGC GGGTCTTCTG GATTAAACGC	3540
AACCGCAACG TCCCCAAACA TAGTCTCAGG ACGAGTTGTA GCAACTTCAA GGGCGCGTGA	3600
ACCATCTTCC AGCATGTAAT TCATGTGGTA GAAGGCACCT TCTACATCCT TGTGAATCAC	3660
CTCAATATCA GAAAGGGCTG TCGGAGCTGC TGGGTCCCAG TTGATGATAA ACTCACCACG	3720
ATAGATCCAG CCTTCTTGT AAAGGTTTAC AAAGACCTTA CGAACAGCTT TTGACAAACC	3780
TTCATCAAGA GTGAAACGCT CACGAGAATA GTCTACAGAA AGCCCCATCT TGCCCCATTG	3840
TTCTTTGATG GTAGTGGCAT ATTCGTCTTT CCATTCCCAG ACCTTCGTCA AGAAAGACTC	3900
ACGACCTAGG TCATAACCGG TAATACCCTC ACCACGTAAG CGCTCCTCAA CCTTAGCCTG	3960
AGTCGCAATA CCAGCGTGGT CCATACCTGG AAGCCAAAGG GTATCAAAGC CTTGCATGCG	4020
TTTTTGACGG ATGATGATAT CCTGCAAAGT CGTATCCCAA GCGTGACCAA GGTGAAGTTT	4080
CCCAGTTACG TTTGGTGGTG GAATCACGAT TGAATAAGGC TTAGCCTTTT GATCGCCTGA	4140
AGGCTTGAAA ACATCCGCAT CAAGCCATTT TTGGTAACGA CCAGCCTCAA CCTCGGCTGG	4200
ATTGTATTTA GGTGAAAGTT CTTTAGACAT GTGTGTGTCC TTTCTCTATT TGTATTATT	4260

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TATTTTGAAT TTGCTTAGCA GCTTCTTCTG CAGACAAATT CGTATTATTT ATTTTAAAGT	4320
AGTGGTGCAA CTCATTCCGT TGATGTGGG AATTTAATTG AAGTGTTCA GCGGTCTCTA	4380
AAATTTCTCT TTCAGATACC TCAATATGTC GTTTTAAGGG TTTGTGCTTT AATCGATTCT	4440
CCGTTTCGATT TCGACGTATG CACTCTTCAA GACTTGTTTC CAATTCAACA AACAGAATCT	4500
CTTGATGAAA GTTATCCAAT AAATCCTGAA TTTGCTTTAA ATACATCAGC TGGTACTGAT	4560
TTGAAAAATC AATTACGTCT GTTAAATTA CTGATCGCTG ATTTCTTGCA CTTGCTCCAA	4620
GGAAAGAAAA GGTAAATCCA CGAACAAATT CCCACATCTC CTCGGTATAA TCCTGATAGA	4680
TCTCTAGTGC AAAATCAATG GCTTGATGGT TATAAAATAG GGTAGCATCC GTCAGTCGAG	4740
ATAATCTCTG ACCAATGGTC ATTTTCCCTG ATGCTGGAGC ACCAATGATG AAAAGATGCA	4800
TCAATCACC TCCCACTCAC TCCTCAGCAA GCCATATCTC AAATCATCAC AGCAGTTGCC	4860
TTGAGCATCT TTGCGGTCTC TTATGCGAGC TTCGAGGGTA AAGCCAAGCT TTTCCGAGAC	4920
TCGTTGACTT TGAAGGTAT ATCCAAAGCA AGTTAGTTCA ATCTTGTGAA GACCAAGTTC	4980
TTTAAAGCT AGATCAATCA AGGAACACGC TGCTTCTGGA ACATAACCTC GACCCAATA	5040
GTCTGGGTGC AAGGTATAGC CAAGCTCTAG CACATCATCC GCATGAAGAT GGTGAAGTC	5100
AACAGAACCA ATGACTTTAT CGGTTCTTTT GACGACAATC CCATAGCCAG CTGGGAGATT	5160
TTCTTTTGA GTACGCTCCG GAAGAATGTG CTCCAGATAA TAAATCTCAT CTTCCAAGAT	5220
CTTGACTGGA GGAACCTG CTGGATAGGC GACCTCTGGC AAAGTAGCGT AGGTATGGAT	5280
ATCCTCAGCA TCCACCACTG TCGGACTCG TAAAACGAGA CGTTCTGTTT CGATTTTATC	5340
TGGCAGCTCA GTTCTTGCCA TCCTTCTTCC TCGCTTTTTT GATGAAACTG CCCTTCATAT	5400
CTACACGCTT GTCCAGATAG CGATAAACGC GCTGATATCC ATCTCCCATG AAATAGGTTG	5460
GGGCAACAG TTGATTTTAA AAATGTCCTT TTTCATCCAG GAGTTCTGGG GCAACAAGTC	5520
GCTCAAGAAT CTTGGCAAAG ATGTGGCAAA TACCGTCTTC CTCAACAATC CTATCTACCC	5580
GACAACTAA AACAGTGGA CAGGCGTCTA AAATAGGAGT CTGAGTTCGT TCAGAAATTT	5640
CATAATGCAC TCCCAAACGT TCCAATTTCT CCTGATGACT GATAAAACCA GCCTGCTCCA	5700
TCGCAAGCAT AGAAGTTTCA TCAGAAATAT TCACAGTAAA TTTTGTATAC TGTTTGATCT	5760
GCTCTGCGGC ATTCTCTCTC GCAACGACTC CAATCACAAC CCAATCTCCT AGACTATAAG	5820
AGGAACTACA GGTGCTGATG TTATAGCCAA AATTCTAATC TTGATATCCT AAAATAAAAA	5880
CAGGAAAACC ATAATATAGT TTACTTGTGT TAAAAGATTG CTTCATAACA ACCCCCTTTG	5940
ACTAAGACGT AAAAGAAAAG CCCTGCCATC TACATGACAG GGACGAATGT GTTTATCCGC	6000
GGGG	6004

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## (2) INFORMATION FOR SEQ ID NO: 28:

## (i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 5857 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: double
- (D) TOPOLOGY: linear

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO: 28:

TGTAGAATTC ACGACAATGC TTCGTTGATT TCTGGGTTGA TTTCGTCGCG TTCTGGCAAG	60
CGAGTCAATG AACCAAAAAT AGTACACAAT GTGGTATAAT CCTTTTATGG CATATTCAAT	120
AGATTTTCGT AAAAAAGTTC TCTCTTATTG TGAGCGAACA GGTAATATAA CAGAAGCATC	180
ACACGTTTTC CAAATCTCAC GTAATACCAT TTATGGCTGG TTAAAGCTAA AAGAGAAAAC	240
AGGAGAGCTA AACCACCAAG TAAAAGGAAC AAAACCAAGA AAAGTTGATA GAGATAGACT	300
TAAAACTAT CTACTGACA ATCCAGATGC TTATTGACT GAAATAGCTT CTGACTTTGG	360
CTGTCATCCA ACTACCATCC ACTATGCGCT CAAAGCTATG GGCTACACTC GAAAAAGAA	420
CCACACCTAC TATGAACAAG ACCCAGAAAA AGTAGCCTTA TTTCTTAAGA ATTTTAATAG	480
TTTAAAGCAC CTAACACCTG TTTAGATTGA CGAAACAGGA TTCGATACTT ATTTTATCG	540
AGAATATGGT CGCTCATTA AAGGTCAGTT AATAAGAGGC AAAGTATCTG GAAGAAGATA	600
TCAGAGGATT TCTTTGGTTG CAGGTCTAAC AAATGGTGAG TTAATCGCTC CAATGACTTA	660
CGAAGAGACG ATGACGAGCG ACTTTTTTGA AGCTTGGTTT CAGAAGTTTC TCTTACCAAC	720
ATTAACCACA CCATCGGTTA TTATTATGGA TAATGCAAGA TTCCATAGAA TGGGGAAGCT	780
AGAATCTTG TGTGAAGAGT TTGGGTATAA ACTTTTACCT CTCCTCCCT ACTCACCTGA	840
GTACAATCCT ATTGAGAAAA CATGGGCTCA TATCAAAAAG CACCTCAAAA AGGTATTACC	900
AAGTTGCAAT ACCTTTTATG AGGCTTTTTT GTCTTGTTCT TGTTTCAATT GACTATATAA	960
ATTGTCTAAG CGAAACAACC GATAAGAATT GGCACAAAAG CGACCGTATT TTTGTTACCA	1020
ATACAGGAAA AACAGTTCAT AGTTCTATCT TGAGCAAGTC TCTCCAGCGA GCAAACGAAC	1080
GCCTTAAAAA ACCAATTCCC AAACATCTGT CCCCTCACAT CTTCAGACAC ACCACTATTA	1140
GCATCTTATC AGAAAAATAA ATTCTTTTAA AAACAATCAC GGACAGGGTT GGTCAATCCG	1200
ACTCTGAAGT CACTACTTCC ATCTACACCC ACGTCACAAA GAACATGAAA GATGAAGCAA	1260
TCAATGTACT GGATAAAGTT ATGAAAAAGA TTTTTTAAAA AGTTTGTGCC CTTTTTGGCC	1320
CTCTAAATAC AAAAATAGCC CTCGGATAA AATCCGAGGG GCTAGAAACG TTGTTAAATC	1380

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AACGGCCGAA CTTTGAATT TCATGGTTCG GGATAAAATA GTTCACTGAA CTATTTTATT	1440
TTTAAAGGTT ATCATAATAT CAAATAGTTC AATTAAATAC GCTAAATTAC TAATATACTT	1500
TTTACCTTTT TCATTCTAAA ATGTAAAGTA CAAACAATTA CAATATACTA GAGGGGGAGT	1560
AAAAAAGGTA TTAATTCGAT GAGTTCAGCA GGCAAGAAAA TAGCACCTTT ACGGGTGCTA	1620
TTTTTTAATT AACGCCACGT TAACTTTTGA TTGATGAATT TTATTGTTTG GCACTTCTTT	1680
CATTTACCGG TAAACATCGA TGAAATCTCT TCCAACATTA TTTTGGAGT TAACTGCATT	1740
TATTTTGTGA TTAATAACTT TTTTAGTATC GAAAGAATGG TTAAAGAAAT CCATAACTAA	1800
CTCTCCTTTC TCATCCTGTA ATCAAGATTT TTATCAATGT CAAAATAGTA TTTTCTATCA	1860
ATCCAAATTG GTCCCTCTCC TTTAGAAATA GCAAGTACAT CTACCGGACC TCCTACTGTT	1920
TCAAGAGTGT TGACAATTTT TCTCTTAAAT GAAGTTAATT CAATAAATGT TTTAGCTGTA	1980
CTCGCCATTT CATTAAGTGG TTGCATTCCA ATAAGGTCTA TTATAGGATT TATATAATAT	2040
TTTTGTGTGA TAGATGATAT ATTTTCAAAT ATATTCTCAA TTTCATCACC CAATCCATTT	2100
TTCTCCATAA CTGATGATAC TTGCTCTGCG ATATATACAT TTAAGTTAGG ATCTATACCA	2160
FTCATAATCG TCTCAACCAT CTCTGACTGT GCAAAAGGGA TTATATGACA AGTTTTATGA	2220
TGATTTATCA CACTTTCATT AATAACTTTC CAAATTAATC GTTTAGAAAA AATTCCATAT	2280
AATTCAATTT GTCTTATAGA TGGAAATATC TCGTCTGTAC CATAACCTGC TATAACTAAT	2340
CCAGTTATGT TTGTGAGTC ATATCCAATG AAAATCGCTT TATATAAAGA TTTAGCAATA	2400
ACTTCAACCT CATCATCAGT ATGAGGAAAG GATTTAAAAA CATCGTCTAC AATGCTTTTT	2460
ATTAACCTTA ACTCAGCTTC AAAAAATTCA AAATTACTTT CAGCTTCTAC TTTTGAAATT	2520
TCTAAACTAA AATTAGTTAT AGCATTAAAT AAAATTTTAT TAAAATCATC TAGAGTGATG	2580
GTTTCACCAT TAGAACTCT TAAATCAGCT GTTCTTTCG CTTCATAGGC AATGCTGTCC	2640
AAAATACTTC TTGTACTTCT GACAATATAA TTTCTTAATA AATCCTCAAC TTGTAGATGT	2700
TTAAAGGAAA TTAATAATTC TATTAGCTTT TCAACGTATT GGGCAGTATT ATCTAATAAA	2760
TCTGTGCCAA TAGCCTGCTT AAATCATTT AAAATTACCT CCCACGGAAT TTCCATAAAC	2820
GAAGCGTTCC CATATATCAT GATCCCCACG GAATGTTCTT TTGATAAAGT GAATAATTTT	2880
CGGGCGCTAT TAAAACTTT TGAATTTTTC CCGTCTGATA AGGTTACAGC GCTATCAGAA	2940
GCCAATACAA CACCATTTTT ATTTAATATT CCAATTTCTG CTGTCAAAAT ATCACCTAAA	3000
CTTCTAAAC CTGCTCATGC TCTAATGGTA CAACAGCTAA GGTCTTACCA AGACTTGCCA	3060
ACACTTTTAA TACTGTATCA AGTTGTGGGC TTGTCTTTC TGTTCCTATT CTAGCGATAA	3120
CTGGCTGACT AACACCGCTC ATCTCCTCTA GTTCTTCTG ACTAATACCC TTTTCATTTT	3180

TAGCCTCGAT AAGCTCACTC ATGATAGCCA CGCGCATATC ACTTTCCAAA ATTCCTCTT	3240
TGCTGAATAA TTCAGCTCTT ACATCTTTCC AGTTACTACC AATAGCATT TTTTCATTG	3300
TCTAAACCTC TTTCTTTTAA ATCTGCAAGT TCACGTTTAG CTGCTCAAT CTCTCTTTG	3360
GGTGTTTCT GTGTCCTTT CATAAAATGA TGCAGTAAAA CAAAACCTACC ATCCATCCAA	3420
GCAACAAATA AAATCTATC TCTAAGTGGT CTCAGCTCCC AAATTCAGC ATCTAAATGC	3480
TTAATATATG GTTCGCCTGC GCGTGTTCCA TGTGGCTTA ACAACTCAAT ATAATCATT	3540
ATTTTATTAA GCTTAATTCT GCTATCTTTC CCTTTTTC TGGTAAGCTC TCGCATATAA	3600
TCAAAAACAG GCTCATTGCC GTTTTATCC TTGTA AAAAT AGATATTATG CACTATTAAC	3660
ACCTCTTCCT AATAACAATT ATAACCTAAA AGTTATTGTT TGTAATACT TTTAAGTTAT	3720
TAAATAAAA AGCACCTAGT TTCCTAGATG CTAGCACAAT GACACGGATT CGCACCGTGG	3780
CTACCTCTAT CAAGGTGTAC TCCTTCTATA CTATCCCTTG TGCTTTAGAA TATTATACCA	3840
CACAATCAAC TAGATACCTA CCATCTCATG ATATACCCCC ATTTTGGGCA AGGGTACAAC	3900
GCTAAATAC AAATCAGAAT AGATATTAAA CCACTTATTT AACTTATCAT AAGCTGGTGA	3960
TTGACTGATA AATAATATCC GCTGACAAGC TCCGATAACA TTCATGTGAT TGTACACATA	4020
AACCTCTTT ACAGCTCTA AAATGTCAGC CTCACTTGT TGTACCCTAA TATCTGTTAT	4080
CTGCTTGATA GTTGCGTATT TTTGATAAGC TAGCATATCT TGATTTTATG CAGCATCAAA	4140
CATTTTACGC TCAAGGACAC TATACTTAGG TTGTTCTTTA TCTCGCATGA AATACCACTT	4200
GAGCCATAAA ATCTTTTCTC GGTGTATTAC AGAAATACGC TCAATTTTCT TCTTTGTCAT	4260
TGCTACCTCC TAAATCATCA ATTTAACAAT TCTAACCCT CACTTTTAGA AATAGTTGCA	4320
TAGATCTTGT TCGATGTATG ATACAAAGGT TCTAAATCTT TTTCCACCCT AATATAGTTC	4380
ATCTTATCCT CATGAGTAGG AAAGTATAGT ATTTCCGTT CATCTCGTT TAGGATACGA	4440
TTGCACCAAT CATCAATAAT AACTGGCACT TCCCACTCAC GCCATTTTTT AAGGTTTTCT	4500
AAAAGTTCAT TATCACTAAA TAGCTGCCA TCTATTGGA AAAATCCCC TAAGTCATTG	4560
TTTCCTTCAA CAATAATAAA CTCTGGCATA TTTCTATTAC TTAATAACTC CTTGAGTTCT	4620
TGTAACCTTT TGATTTCTT TAGATACTTC CTCAATTTCC AACCTCAATT CTTCAATCTG	4680
CCTTACTACT CAAAAAATT CATGGGTCTT ATAAGATTGT TCAAGTATAG CCTTTGCTGC	4740
TTGAGTTCTT ATAAACGGGT TGACCTTACT GTCCATCATA ATATCATTGA GTACAGAAAC	4800
AGCGTTAGAT GATGCTAAAT AAAGCATTG AGTTGTTTTA TCCATCATCT CATCTTGCTT	4860
TATCCTCAAT GTCTTTTAA CCGCTGCAAC TTTTAGATAC TTATGACCTG TTGCGCGTGA	4920

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TACCCCTGCT TTTTGACATG CTTTGTCTAT CGTTGGCTCG GTAAGCATGG CATCTATGAA	4980
TTTAATTTGC TTGGACGTAA GGTATCATTT TTCATTTCCT GCCATCTATT ACCTCCTCAT	5040
TATCAAAATA AAGGGTTGCC CCTTTATTTT CCTATGCTAG ATAATTCTGC AATTCTGCAT	5100
CCATTGCCCTC TGAATTGCCC TCAACAATCA TTTCATGCTG TACTAAATCA ATCTTATCTC	5160
CGTTAATAAG TAAACCACCG TGGAAATAAT CAATTTTCT ATCAAGGAAA TGTACTAGCT	5220
TTTCAAGGCG TTGCTGTTGG CTGAATTGCT CCATGTCAAT TTCGATATAA GCAAGGGTAG	5280
TATCATTATC CATAATATCT TCTAATTTT TAAGAGCTAG AGGTTTATTT TTATATTTTT	5340
CTAGGTATTC TCTCATTTCT GCCACTGTTA ATTTGATACT AGATAATAAA CTTAGTTCAG	5400
CTGCATCATC TGCTGTAATA GGCTCTTCTT TTGATTCATG GTTTGCTAGT TCAGCATTTT	5460
TCTCTTTTTT TAGTTGCTGA TACAATAGCT GAGCAGTATT TTGGGAATAG TTTTCGCCCT	5520
CTTTTTTATA TTTTAAAAGT TCTTGCTCTG CATACACTTT CCCGATAATC ACTTCCTTAT	5580
AAACTAATTG CCCATCTTGA GCTTTTAGCT TAATACTCCC ATGCTCTGGA ATTTCAATAT	5640
ACTTAATTAT ACCATTTTTT GAGTATAAAA CAAAGCCTTT CTCCATCATT TTTAATAATT	5700
TATCATCCTT GTTTTCAGTC ATGCTTTTCT CCTTTATTTT ATTTTATTAT AATCTGAATA	5760
CCCCTAGTCT ATTTATTTCA CTAGGTTTTT AGGGTTCGTA TGCTAAAATA CTACCCTTTT	5820
TGTGTACCTT ATGGCTGACT TTCAAATTG GTTAGTT	5857

## (2) INFORMATION FOR SEQ ID NO: 29:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 10254 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO: 29:

AAAATGATAG CAGGAGAGTT TTCCCGTCCA TCAGACCCAG AACTGAGAGC CTTAGCTCAG	60
GCTTCTCGCC AAAACAGGC CGCCTTTAAC AAGGAAGAGA ACCCCTTGAA GGGAGCCGAA	120
ATCATCAAGA CTGGTTTGC CTCAACCGGG AAAAATCTTT ACATCAACAC TCGCTTGATG	180
GTGGACTACG GTGTCAACAT CCATCTAGGG GAAAAATTTT ATTCTAATTG GAACTTGACC	240
ATGCTGGATA TCTGTCCCAT TCGTATCGGG GACAATGCTA TGATTGGTCC TAATTGTCAG	300
TTTTTGACAC CCCTCCATCC ACTAGATCCA CAGGAACGCA ATTCAGGTAT CGAGTACGGA	360
AAGCCTATCA CAATCGGAGA TAATTCTGG ACTGGTGGTG GCGTCATTGT CCTTCCTGGA	420
GTGACACTGG GAAATAATGT CGTTGCAGGA GCAGGGCAG TAATTACCAA ATCTTTTGGC	480



GACAACTTG TCCTAGCTGG CAATCCTGCG CGCGTGATTA AGGAAATACC TGTAAATAG	540
AAGTAAAAAG GAACAGCTGG GGTGTTTCT TTTTGTAGG TTTTCATCATT TTTTACCCAG	600
TTTACATTAA CCTACTCTAT CTCTTAGCAA GTCTGTTTCA TTAAGCAAGT TCAAAGCATC	660
TCGTAAGTGG GATGTTTTTC TCCTCAGTTC ATCAGCTTCC TCCTTGACAC TCGGTCAGAT	720
TTTGATACAA TAGTACAAAA TTAGAGGAGG CAGGCTATGA TTCAGAAACA TGCGATTCTT	780
ATTTTAGAGT TTGATGACAA TCCTCAGGCG GTTATCATGC CCAATCACGA GGGGCTGGAC	840
TTGCAGTTGC CAAAGAAGTG TGTATTATGCA TTTTLAGGTG AGGAGATTGA CCGCTATGCG	900
AGGGAAGTAG GGGCGAAGTG TGTGGCGAA TTTGTTTCTG CCACCAAGAC CTATCCAGTT	960
TATGTCGTGA ACTACAAGGA CGAGGAGGTC TGTCTGGCTC AGGCTCCTGT TGGCTCCGCT	1020
CCAGCAGCCC AGTTTATGGA TTGGTTGATT GGCTATGGTG TGGAGCAGAT TATCTCTACT	1080
GGGACCTGTG GTGTCCTAGC TGATATAGAG GAAAATGCCT TTCTAGTCCC TGTTCGCGCT	1140
CTGCAGATG AAGGAGCCAG TTACCACTAT GTGGCACCTT GTCGTTATAT GGAAATGCAG	1200
CCAGAGGCTA TTGCTGCTAT TGAGGAAGTT TTGGAAGACA GAGGGATTCC TTATGAAGAA	1260
GTATGACCT GGACGACAGA CGGTTTTTAC CGAGAAACGG CTGAAAAGGT GGCTTATCGT	1320
AAGGAAGAAG GCTGTGCTGT TGTGGAGATG GAGTGTCTG CTCTGCGGC AGTAGCTCAA	1380
TTGCGTGGG TTCTCTGGG TGAATTGTTG TTCACAGCAG ATTCTCTAGC GGAATTGGAC	1440
CAGTACGACA GTCGTGACTG GGGCTCGGAA GCTTTTAATA AGGCGCTAGA ACTGAGTTTA	1500
GCAAGTGTTC ACCACCTTTA GTTGTACTGG CAAAGGATTT GTTTTATCAT AAAATGTCTA	1560
GCTCATACTT TTCAAAAATA TGTTTAAACG AGGTCACCTT CCTCTTGTC TAGGCATGTT	1620
GAGGTTGGGA AAAATCTTTA AAATCAGAAA AACGTATCAT ATCAGGTGAT GAAAACCTTG	1680
ACACTATGCG TTTTATGTCG ATAAGATTTA GAGTGAGATG AAATGATACT CTTGCAAAAT	1740
CTCTTCAAAC CAGGTCAGCT TCACCTTGCC GTAGGTATAT GTTACTGACT TCGTCAGTCT	1800
TATCCGGCAA CCTCAAAACG GTGTTTTGAG CTGACTTCGT CAGTTCTATT TGCAACCTCA	1860
AAACAGTGT TTGAGCAACC TGTGACTAGC TTTCTAATCG ATGCCTTGGT TTTCATTGCC	1920
TATAATCAAA AAGAGAAATT TTCTCTGAA AAGCATATAG AGTAGCTGGC GTTAAAAGCT	1980
CCTGCTTGC TTTTGTGACC TATAGTCACA TCTATCAAGT ATTGTTCTTG CTTAAGCTAT	2040
CAATAAAAAG GTGGCATTTT TTAGGCTTGG TGTTAGTAGA TTTTGCCTTA TCCTATCTAA	2100
GTCAATTGCA ACTTTTATG GTACAATGGA AACATGTTAT TCAAATTATC TAAGGAAAAA	2160
ATAGAGCTAG GCTTATCTCG TTTATCGCCA GCCCGTCGTA TTTTGTGAG TTTTGCCTTG	2220

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GTCATTTTAC TAGGCTCTCT TCTTTTGAGC TTGCCCTTTG TCCAAGTTGA AAGCTCACGA	2280
GCGACTTATTTTATCATCT TTCACTGCT GTCTCTGCAG TCTGTGTGAC GGGTCTCTCA	2340
ACCCCTTCCAG TAGCTCACAC CTATAATATC TGGGGTCAAA TAATCTGTTT GCTCTTGATT	2400
CAGATCGGTG GTCTAGGGCT CATGACCTTT ATTGGGGTTT TCTATATCCA GAGCAAGCAA	2460
AAGCTTAGTC TTCGTAGCCG TGCAACTATT CAGGATAGTT TTAGTTATGG AGAAACTCGA	2520
TCTTTGAGAA AGTTTGTCTA TTCTATTTTT CTCACGACCT TTTTGGTTGA GAGCTTGGGA	2580
GCTATTTTGC TTAGTTTTCG CCTATTTCCT CAACTTGGCT GGGGACGTGG TCTTTTTAGT	2640
TCCATTTTTC TAGCGATCTC AGCCTTCTGT AATGCCGGTT TTGATAATTT AGGGAGCACC	2700
AGTTTATTTG CTTTTCAGAC CGATTTACTG GTCAATCTGG TGATTGCAGG CTTGATTATT	2760
ACAGGCGGCC TTGGTTTTAT GGTCTGGTTT GATTTGGCTG GTCATGTAGG AAGAAAGAAA	2820
AAAGGACGTC TGCACTTTCA TACGAAGCTT GTACTATTAT TGACTATAGG TTGTGTGTTA	2880
TTTGGAACAG CAACTACTCT CTTTCTTGAG TGGAAACAATG CTGGAACGAT TGGCAATCTC	2940
CCTGTGCGG ATAAGGTTTT AGTTAGCTTT TTTCAAACAG TGACGATGCG AACAGCTGGC	3000
TTTTCTACGA TAGATTATAC TCAGGCTCAT CCTGTGACTC TTTTGATTTA TATCTTACAG	3060
ATGTTTCTAG GTGGGGCACC TGGAGGAACA GCTGGGGGAC TCAAGATTAC GACATTTTTT	3120
GTCCCTCTTG TCTTTCACAG AAGTGAGCTT CTAGGCTTGC CTCATGCCAA TGTTCGAGA	3180
CGAACGATCG CGCCGCGAAC GGTTCAAAA TCCTTTAGTG TCTTTATTAT CTTTTTGATG	3240
AGCTTCTTGA TAGGATTGAT TCTGCTAGGG ATAACAGCCA AAGGCAATCC TCCCTTTATC	3300
CACCTCGTAT TTGAACCAT TTCAGCTCTT AGTACAGTTG GTGTAACGGC AAATCTGACT	3360
CCTGACCTTG GGAAATTGGC TCTCAGTGTT ATCATGCCAC TTATGTTTAT GGGACGAATT	3420
GGTCCCTTGA CCTTGTGTTGT TAGCTTGGCA GATTACCATC CAGAAAAGAA AGATATGATT	3480
CACTATATGA AAGCAGATAT TAGTATTGGT TAAGAAAGGA AAGAGCATGT CAGATCGTAC	3540
GATTGGAATT TTGGGCTTGG GAATTTTGG GAGCAGTGTC CTAGCTGCCC TAGCCAAGCA	3600
GGATATGAAT ATTATCGCTA TTGATGACCA CGCAGAGCGC ATCAATCAGT TTGAGCCAGT	3660
TTTGGCGCGT GGAGTGATTG GTGACATCAC AGATGAAGAA TTATTGAGAT CAGCAGGGAT	3720
TGATACCTGC GATACCGTTG TAGTCGCGAC AGGTGAAAAT CTGGAGTCGA GTGTGCTTGC	3780
GGTTATGCAC TGTAAGAGTT TGGGGGTACC GACTGTTATT GCTAAGGTCA AAAGTCAGAC	3840
CGCTAAGAAA GTGCTAGAAA AGATTGGAGC TGACTCGGTT ATCTCGCCAG AGTATGAAAT	3900
GGGGCAGTCT CTAGCACAGA CCATTCTTTT CCATAATAGT GTTGATGTCT TTCAGTTGGA	3960
TAAAAATGTG TCTATCGTGG AGATGAAAAT TCCTCAGTCT TGGGCAGGTC AAAGTCTGAG	4020

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TAAATTAGAC CTCGTGGCA AATACAATCT GAATATTTTG GGTTCGAG AGCAGGAAAA	4080
TTCCCCATTG GATGTTGAAT TTGGACCAGA TGACCTCTTG AAAGCAGATA CCTATATTTT	4140
GGCAGTCATC AACCAACAGT ATTTGGATAC CCTAGTAGCA TTGAATTCGT AAAGAGGGAT	4200
GACCCCTCTT TTTTGATGCC TAAGATGGCA AATAGAGACA GAAGCCCTT GTCTTCTAGT	4260
AAAAGTTCTT CAAAGGCTGG ACTTTATGGT AAAATAGAAA GAAGTGACAA GAGAGAGTAA	4320
TACTCAATGA AAATCAAAGA TCAAACTAGG AAAGTAGCTA CGGGCTGCTC AAAACACTGT	4380
TTTGAGGTTG CAGATAGAAC TGACGAAGTC AGTAACATCT ATACGGCAAG GCGACGTTGA	4440
CGCGGTTTGA AGAGATTTTC GAAGAGTATA AGAAAAATC AGTCCCTTAA AGGAGTAGAT	4500
TATGAAGTTA TTGTCTATCG CAATTCTAG CTATAATGCA GCAGCCTATC TTCATTACTG	4560
TGTGGAGTCG CTAGTGATTG GTGGTGAGCA AGTTGGGATT TTGATTATCA ATGACGGGTC	4620
TCAGGATCAG ACTCAGGAAA TCGCTGAGTG TTTAGCTAGC AAGTATCCTA ATATCGTTAG	4680
AGCCATCTAT CAGGAAAATA AATGCCATGG CGGTGCGGTC AATCGTGGCT TGGTAGAGGC	4740
TTCTGGGCGC TATTTTAAAG TAGTTGACAG TGATGACTGG GTGGATCCTC GTGCCTACTT	4800
GAAAATTCIT GAAACCTTGC AGGAACTTGA GAGCAAAGGT CAAGAGGTGG ATGTCITTTGT	4860
GACCAATTTT GTCTATGAAA AGGAAGGGCA GTCTCGTAAG AAGAGTATGA GTTACGATTC	4920
AGTCTGCTT GTTCGGCAGA TTTTGGCTG GGACCAGGTC GGAAATTTCT CCAAAGGCCA	4980
GTATACCATG ATGCACTCGC TGATTATCG GACAGATTTG TTGCGTGCTA GCCAGTTCTA	5040
ACTGCCTGAA CATACTTTTT ATGTCGATAA TCTCTTTGTC TTTACGCCCC TTCAGCAGGT	5100
CAAGACCATG TACTATCTGC CTGTCGATTT CTATCGTTAT TTGATTGGGC GTGAGGACCA	5160
GTCTGTCAAT GAGCAAGTGA TGATTAAGTG CATTGACCAG CAACTCAAGG TCAATCGACT	5220
CTTGATAGAC CAACTTGATT TGTCCTCAAGT GAGTCATCCC AAAATGCGAG AATATCTGCT	5280
GAATCATATT GAACTCACGA CGGTGATTTT CAGTACCCTG CTCAACCGAT CTGGAACAGC	5340
GGAGCATCTG GCAAAAAAAC GCCAATTGTG GACCTATATT CAGCAGAAAA ATCCAGAAGT	5400
CTTTCAGGCT ATTCGTAAGA CCATGTTGAG CCGTTTGACC AAACATTCTG TCTTGCCAGA	5460
TCGCAAACTG TCCAATGTCG TCTATCAAAT CACCAAATCT GTTTATGGAT TTAATTAATA	5520
TAAGTGTTTT ATAAGAGGGA TTAAAGAAAA ATTTTAACTT TTTCTTAGTC CTTTTTAATT	5580
TCAGGAGATT ATACTAGAGT CATCAAATAA AGAAAGACTC TAAGGAGAAT CCTATGAAAT	5640
TCAATCCAAA TCAAAGATAT ACTCGTTGGT CTATTCGCCG TCTCAGTGTC GGTGTTGCCT	5700
CAGTTGTTGT GGCTAGTGGC TTCTTTGTCC TAGTTGGTCA GCCAAGTTCT GTACGTGCCG	5760

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ATGGGGCTCAA TCCAACCCCA GGTCAAGTCT TACCTGAAGA GACATCGGGA ACGAAAGAGG	5820
GTGACTTATC AGAAAAACCA GGAGACACCG TTCTCACTCA AGCGAAACCT GAGGGCGTTA	5880
CTGGAAATAC GAATTCACCT CCGACACCTA CAGAAAGAAC TGAAGTGAGC GAGGAAACAA	5940
GCCCTTCTAG TCTGGATACA CTTTTTGAAG AAGATGAAGA AGCTCAAAAA AATCCAGAGC	6000
TAACAGATGT CTTAAAGAA ACTGTAGATA CAGCTGATGT GGATGGGACA CAAGCAAGTC	6060
CAGCAGAAAC TACTCCTGAA CAAGTAAAAG GTGGAGTGAA AGAAAAATACA AAAGACAGCA	6120
TCGATGTTCC TGCTGCTTAT CTTGAAAAAG CTGAAGGGAA AGGTCCTTTC ACTGCCGGTG	6180
TAAACCAAGT AATTCCTTAT GAACTATTCG CTGGTGATGG TATGTTAACT CGTCTATTAC	6240
TAAAAGCTTC GGATAATGCT CCTTGGTCTG ACAATGGTAC TGCTAAAAAT CCTGCTTTAC	6300
CTCCTCTTGA AGGATTAACA AAAGGGAAAT ACTTCTATGA AGTAGACTTA AATGGCAATA	6360
CTGTTGGTAA ACAAGGTCAA GCTTTAATTG ATCAACTTCG CGCTAATGGT ACTCAAACCT	6420
ATAAAGCTAC TGTATAAGTT TACGGAAATA AAGACGGTAA AGCTGACTTG ACTAATCTAG	6480
TTGCTACTAA AAATGTAGAC ATCAACATCA ATGGATTAGT TGCTAAAGAA ACAGTTCAAA	6540
AAGCCGTTGC AGACAACGTT AAAGACAGTA TCGATGTTCC AGCAGCCTAC CTAGAAAAAG	6600
CCAAGGGTGA AGGTCCATT CACAGCAGGTG TCAACCATGT GATTCCATAC GAACTCTTCG	6660
CAGGTGATGG CATGTTGACT CGTCTCTTGC TCAAGGCATC TGACAAGGCA CCATGGTCAG	6720
ATAACGGCGA CGCTAAAAAC CCAGCCCTAT CTCCACTAGG CGAAAACGTG AAGACCAAAG	6780
GTCAATACTT CTATCAAGTA GCCTTGGACG GAAATGTAGC TGGCAAAGAA AAACAAGCGC	6840
TCATTGACCA GTTCCGAGCA AAYGGTACTC AAACCTACAG CGCTACAGTC AATGTCTATG	6900
GTAACAAAGA CGGTAAACCA GACTTGGACA ACATCGTAGC AACTAAAAAA GTCACTATTA	6960
ACATAAACGG TTTAATTTCT AAAGAAACAG TTCAAAAAGC CGTTGCAGAC AACGTTAAAG	7020
ACAGTATCGA TGTTCAGCA GCCTACCTAG AAAAAGCCAA GGGTGAAGGT CCATTCACAG	7080
CAGGTGTCAA CCATGTGATT CCATACGAAC TCTTCGCAGG TGATGGTATG TTGACTCGTC	7140
TCTTGCTCAA GGCATCTGAC AAGGCACCAT GGTGAGATAA CGGTGACGCT AAAAACCAG	7200
CCCTATCTCC ACTAGGTGAA AACGTGAAGA CCAAAGGTCA ATACTTCTAT CAATTAGCCT	7260
TGGACGGAAG TGTAGCTGGC AAAGAAAAAC AAGCGCTCAT TGACCAGTTC CGAGCAAACG	7320
GTACTCAAAC TTACAGCGCT ACAGTCAATG TCTATGGTAA CAAAGACGGT AAACCAGACT	7380
TGGACAACAT CGTAGCAACT AAAAAGTCA CTATTAAACAT AAACGGTTTA ATTTCTAAAG	7440
AAACAGTTCA AAAAGCCGTT GCAGACAACG TTAAGGACAG TATCGATGTT CCAGCAGCCT	7500
ACCTAGAAAA GGCCAAGGGT GAAGGTCCAT TCACAGCAGG TGTCAAACCAT GTGATTCCAT	7560

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ACGAACTCTT CGCAGGTGAT GGCATGTTGA CTCGTCTCTT GCTCAAGGCA TCTGACAAGG	7620
CACCATGGTC AGATAACGGC GACGCTAAAA ACCCAGCTCT ATCTCCACTA GGTGAAAACG	7680
TGAAGACCAA AGGTCAATAC TTCTATCAAG TAGCCTTGGA CGGAAATGTA GCTGGCAAAG	7740
AAAAACAAGC GCTCATTGAC CAGTCCGAG CAAACGGTAC TCAAACCTAC AGCGCTACAG	7800
TCAATGTCTA TGGTAACAAA GACGGTAAAC CAGACTTGGA CAACATCGTA GCAACTAAAA	7860
AAGTCACTAT TAAGATAAAT GTTAAAGAAA CATCAGACAC AGCAAATGGT TCATTATCAC	7920
CTTCTAACTC TGGTCTGGC GTGACTCCGA TGAATCACAA TCATGCTACA GGTACTACAG	7980
ATAGCATGCC TGCTGACACC ATGACAAGTT CTACCAACAC GATGGCAGGT GAAAACATGG	8040
CTGCTTCTGC TAACAAGATG TCTGATACGA TGATGTCAGA GGATAAAGCT ATGCTACCAA	8100
ATACTGGTGA GACTCAAACA TCAATGGCAA GTATTGGTTT CCTTGGGCTT GCGCTTGACG	8160
GTTTACTCGG TGGTCTAGGT TTGAAAAACA AAAAAGAAGA AAATAATCA GCTAAGGAAA	8220
TAAATGATGG ATAGTGGGCT GACTAAGATT AGTTTAACAA CTCAATCAGC AATCAGGACT	8280
TTCTTTCAAT AGCAGATTAA AATCATCGTA AAACAATAAA AATAGTGTTA TACTTAAAGC	8340
AGTATAGCAC TGTTTTTATC AAAGGAGAGA CAGATGGGAA AGACAATTTT ACTCGTTGAC	8400
GACGAGGTAG AAATCACAGA TATTCATCAG AGATACTTAA TTCAGGCAGG TTATCAGGTC	8460
TTGGTAGCCC ATGATGGACT GGAAGCGCTA GAGCTGTTCA AGAAAAAACC GATTGATTG	8520
ATTATCACAG ATGTCATGAT GCCTCGGATG GATGGTTATG ATTTAATCAG TGAGGTTCAA	8580
TACTTATCAC CAGAGCAGCC TTTCTATTT ATTACTGCTA AGACCACTGA ACAGGACAAG	8640
ATTTACGGCC TGAGCTTGGG AGCAGATGAT TTTATTGCTA AGCCTTTTAG CCCACGTGAG	8700
CTGGTTTTCG GTGTCCACAA TATTTTGCGC CGCCTTCATC GTGGGGGCGA AACAGAGCTG	8760
ATTTCCCTTG GCAATCTAAA AATGAATCAT AGTAGTCATG AAGTTCAAAT AGGAGAAGAA	8820
ATGCTGGATT TAACTGTTAA ATCATTTGAA TTGCTGTGGA TTTTAGCTAG TAATCCAGAG	8880
CGAGTTTCT CCAAGACAGA CCTCTATGAA AAGATCTGGA AAGAAGACTA CGTGGATGAC	8940
ACCAATACCT TGAATGTGCA TATCCATGCT CTTGACAGG AGCTGGCAAA ATATAGTAGT	9000
GACCAAACTC CCACTATTAA GACAGTTTGG GGGTTGGGAT ATAAGATAGA GAAACCGAGA	9060
GGACAAACAT GAAACTAAAA AGTTATATTT TGGTTGGATA TATTATTTCA ACCCTCTTAA	9120
CCATTTTGGT TGTTTTTTGG GCTGTTCAAA AAATGCTGAT TGCGAAAGGC GAGATTTACT	9180
TTTTGCTTGG GATGACCATC GTTGCCAGCC TTGTCGGTGC TGGGATTAGT CTCMTTCTCC	9240
TATTGCCAGT CTTTACGTGC TTGGGCAAAC TCAAGGAGCA TGCCAAGCGG GTAGCGGCCA	9300

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AGGATTTTCC TTCAAATTTG GAGGTTCAAG GTCCTGTAGA ATTTTCAGCA TTAGGGCAAA	9360
CTTTTAATGA GATGTCCCAT GATTTGCAGG TAAGCTTTGA TTCCTTGGAA GAAAGCGAAC	9420
GAGAAAAGGG CTTGATGATT GCCCAGTTGT CGCATGATAT TAAGACTCCT ATCACTTCGA	9480
TCCAAGCGAC GGTAGAAGGG ATTTTGGATG GGATTATCAA GGAGTCGGAG CAAGCTCATT	9540
ATCTAGCAAC CATTGGACGC CAGACGGAGA GGCTCAATAA ACTGGTTGAG GAGTTGAATT	9600
TTTTGACCCT AAACACAGCT AGAAATCAGG TGGAAACTAC CAGTAAAGAC AGTATTTTTC	9660
TGGACAAGCT CTTAATTGAG TGCATGAGTG AATTTTCAGTT TTTGATTGAG CAGGAGAGAA	9720
GAGATGTCCA CTTGCAGGTA ATCCCAGAGT CTGCCCGGAT TGAGGGAGAT TATGCTAAGC	9780
TTTCTCGTAT CTTGGTGAAT CTGGTCGATA ACGCTTTTAA ATATTCTGCT CCAGGAACCA	9840
AGCTGGAAGT GGTGGCTAAG CTGGAGAAGG ACCAGCTTTC AATCAGTGTG ACCGATGAAG	9900
GGCAGGGTAT TGCCCCAGAG GATTTGGAAA ATATTTTCAA ACGCCTTTAT CGTGTGCAAA	9960
CTTCGCGTAA CATGAAGACA GGTGGTCATG GATTAGGACT TGCGATTGCG CGTGAATTGG	10020
CCCATCAATT GGGTGGGGAA ATCACAGTCA GCAGCCAGTA CGGTCTAGGA AGTACCTTTA	10080
CCCTCGTTCT CAACCTCTCT GGTAGTGAAT ATAAAGCCTA AAACCCCTTT ACAAAATCCAG	10140
CTATTCATGG TAGAATAGAT TTTGTGTGAA ATATCAGCAG GAAAGCATGA AGCTCGTCAA	10200
CAGGTGTCTT ATGACAAGTA ACCTTGGCTG TTTAGGCGAA GGGCATCTGC ACGG	10254

## (2) INFORMATION FOR SEQ ID NO: 30:

## (i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 9769 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: double
- (D) TOPOLOGY: linear

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO: 30:

CCGGCGACTA TCGATAACAC TTGACTTGGT AGCCCCACAT TTTGGACAAC GCATCCTTTC	60
CCTCCTTATC GTTTTCTTTT CATTATACCA TTTTTTAAGC GATTCCCAAA ACAATTCTTC	120
TTTTTGCTTG ACAAGTTTTT TGTTTTGTG TATTATTTAA TTAAGACAAC AAGGTAAAAG	180
AAAGGAGACT AAGATGTCTT GGACATTGTA CAACAAAAAA CCCATCTATT TACAGATTAT	240
GGAGAAAATC AAGCTTCAGA TTGTTTCCCA TACTCTGGAA CCCAATCAAC AACTTCCAAC	300
CGTGAGGAGC TAGCTAGCGA GGCTGGTGTC AATCCCAATA CCATCCAAG AGCCTTATCA	360
GACCTTGAAC GAGAAGGATT TGTCTACAGC AAGCGAACAA CTGGACGATT TGTGACTAAG	420
GATAAGGAGC TAATCGCCCA GTCACGCAAA CAATTATCAG AAGAAGAATT GGAACACTTC	480

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GTTTCCTCCA TGACCCATTT TGGCTATGAA AAAGAAGAAC TACCAGGCGT AGTCAGTGAT	540
TATATTAAAG GAGTTTAAGC CTATGTCATT ACTAGTATTT GAAAATGTAT CCAAATCATA	600
TGGAGCAACA CCAGCCCTTG AAAATGTTTC TCTTGACATT CCAGCTGGAA AAATGTGCGG	660
CCTTCTTGGG CCAAACGGCT CAGGAAAAAC AACCTGATT AAAC TAATTA ATGGCCTCTT	720
ACAACCAGAT CAAGGACGTG TCCTCATCAA CGACATGGAC CCAAGCCCAG CAACCAAGGC	780
CGTTGTAGCT TATTTGCCTG ATACGACCTA TCTCAATGAG CAAATGAAGG TCAAAGAAGC	840
CCTAACCTAC TTCAAGACCT TCTATAAAGA TTGTCAGATC TTGAACGCGC CCATCATCTA	900
CTTGACAGCC TGGGCATTGA TGAAAATAGT CGTCTCAAGA AACTATCAAA AGGAAACAAA	960
GAAAAGGTC AACTGATTTT GGTATGAGC CGTGATGCTC GTCTCTATGT TTTGGACGAA	1020
CCCATTGGTG GGGTGGATCC AGCAGCCCGT GCTTATATCC TCAATACCAT TATCAACAAC	1080
TACTACCAA CTTCTACCGT TTTGATTTCT ACCCACTTGA TTTCTGATAT CGAGCCAATC	1140
TTGGATGAAA TTGTCTTCTT AAAAGACGGA AAAGTCGTCC GTCAGGAAA TG TAGATGAT	1200
ATTCGCTACG AGTCAGGTGA ATCCATTGAC CAACTCTTCC GTCAGaATTT AAGGCCTAAG	1260
CAAAGGAGAT TATTTATGTT TTGGAATTTA GTTCGCTACG AATTTAAAAA TGTTAACAAG	1320
TGGTATTTAG CCCTCTACGC AGCCGTGCTA GTCCTTTCTG CCCTCATCGG AATACAGACA	1380
CAAGGCTTTA AAAATCTACC TTACCAAGAA AGTCAGGCTA CTATGCTACT TTTCTAGCT	1440
ACAGTCTTTG GTGGCTTGAT GCTTACACTT GGGATTTCAA CCATTTTCTT GATTATTAAA	1500
CGCTTCAAAG GTAGTGTCTA CGACCGACAA GGCTATCTGA CTTTGACCTT GCCAGTTTCT	1560
GAACACCATA TCATCACAGC CAAACTAATC GGTGCCTTTA TCTGGTCATT GATTAGCACC	1620
GCTGTATTGG CTCTAAGTGC TGTTATTATT CTGGCTTTAA CAGCTCCAGA ATGGATTCTT	1680
CTTTCTTATG TGATTACATT TG TAGAAACA CATCTCCCTC AGATCTTTCT TACAGGTATA	1740
TCCTTCCTAC TAAATACTAT TTCAGGAATC CTCTGCATCT ACCTGGCTAT TTCCATTGGA	1800
CAGCTTTTCA ATGAATACCG TACAGCACTC GCTGTTGCAG TCTACATTGG TATCCAAATC	1860
GTCATTGGAT TTATTGAACT TTTCTTCAAT CTTAGTTCTA ATTTCTATGT CAATTCACCTG	1920
GTAGGACTCA ATGACCATTT CTATATGGGA GCAGGTATAG CCATTGTTGA AGAACTCATA	1980
TTCATAGCTA TCTTTTATCT CGGAACCTAC TACATCTTGA GAAATAAGGT TAATTTGCTT	2040
TAAATAATTT TTACCTAGAT ATGTAACATA CTCATAGAAC AAAAGAGACC AGGCAAAAAG	2100
TCTTTAAAAT TAGAAAACGC ATAGTATCAG GTGTTGAATA TG TACTGCCc CCCAAAAGTT	2160
AGATTTTTC TGTCTAACTT TTGGGGGCAG TTCATAAGAA CCTTGGTAAT ATGCGTTTT	2220

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TGTGAGCTGA	CTTATTTCTT	TTCACCTATAT	CGCAAAATGA	AATAAGAACG	GAACGATGGG	2280
ATTTTGGAAT	TCAAATCAAT	TTATAAGAAT	GTTTGTAGAAG	TAATATTATC	CTATTCCAGA	2340
TTCAGTTTAC	TATACAATTG	AGTTTTCAGG	CAACCTGTTT	ACATAATGTG	TACATAATTA	2400
GGTTCGTGAT	TCCACCCCTT	TCACCTTTAA	AAACCTCGCT	TTCGCAAGGC	TCTTCTATTT	2460
ATAAGATAAG	GCACGTTTAA	AGGTTTTCCT	AATCCCTAAA	TCATCCGTTT	GAAGAACGAG	2520
ACTAGCATAC	ATGCGTCCGA	TAAATCCTGT	TGCTACCACC	GCAAAAATCA	CTGTAATAGC	2580
AAGTGAAATC	CATGCTTCTG	CTCCCCCGC	ATAGTCATTA	ATCGTTCGAA	ACGGCATAAA	2640
GAAGGTCGAA	ATAAAGGGAA	TATAAGAACC	AATCTTCAAG	AGGAGATTGT	CACCAGCTGC	2700
ACCTAGAGCT	GTCACCTCAA	AAAAACCACC	CATAATCAAA	ATCATCAAG	GCGACAAGGC	2760
TTTCCCTGAG	TCCTCAGGAC	GAGAAACCAT	AGATCCTAGG	AAGGCTGCCA	AGACTACGTA	2820
CATGAAAAGA	CTGATCAAAA	TAAAGAGCAA	GGTATTCAGT	GAGATAGCAT	CTCCCAAGTG	2880
ATCCAAAATA	CCAGACTGAG	CCAAGAATGG	CAAATCTTTA	AAGAGCAAAA	CGGCAGCCAG	2940
ACCACCTACA	ACATAGATCC	CAATATGCGT	TAAATCACT	AGAAACAGAG	CCATCATCCG	3000
CGCATAGAAA	TAGTGACTTG	CCCTTATGCT	AGAAAAACG	ACTTCCATAA	TTTTGGTGCC	3060
TTTTTCACTG	GCAACTTCCT	GAGCTGTAC	ACCCGCATAG	GTAATCAGAA	TCATATAAAG	3120
AAAGAATCCT	AAGGCACCTG	CTGCAATTGT	TTGAATAAAC	TTTTTATTTT	CCTTGGCTTC	3180
ATCAATCTTT	TCTGTGAATT	GAATTGTCTG	CGCTAAGCGT	TTTTCTGCT	CTTGAGACAA	3240
GGAAGCAGTT	GAACGATTAA	GCTGATTTTG	CAGTTCATTG	AGTGACCTG	TAACCTCAAA	3300
TTTAATTCCA	TTTTCAAGCG	ATGTTTCGCC	ATGATAAACT	GCCTTTAGAA	CACTATCTTC	3360
TTGATCAATG	GTCAAATAAC	CTTTTAATTT	TTCTTCTTTA	ATTGCTTCTT	TGGCACTTGC	3420
TTCTGCTTTA	TAGTCGAAGT	TAACACCATT	TACATTCTTC	AGTCCTTCTG	CTACAGATGG	3480
CACTGTTGTC	ACTACTGCCA	CTTTATTATT	TTTAGCCATA	GAAGAACCTT	GGAGATGCCC	3540
AATTCCTACA	GAGATTCCCTA	AAAAGAGGAA	CGGCGAAATC	ACCATAAAGA	AGAAACTCCA	3600
TGACTCGACA	TGTCGAAGAT	AGGTTTCCTT	GATTACAACC	CACATATTTC	TCATACTTCC	3660
ACTCCTGATT	CTAGTTTAAA	GATTTTCATG	ATAGTTGGCG	CTTGTGGTTC	AAATGTTGCG	3720
ATATATTGAC	CTTGAGTCAA	GATTGAGAAG	AGTTCCTTTC	CAGCGCTCTC	ATCCTCCAAA	3780
ATCAATTTCC	AACTGCCTTG	TTTGGTCAAG	CTCACCTGTT	TGACATGAGG	AAGATTTTCC	3840
AATCTTCTCT	TGCTTCGTTT	ACTTGAACAA	AAGAGACGCG	TTTTCCCGTA	TTGATTGCGG	3900
ACATCCTGAA	CTGGTCCGTG	CAAGACCACA	CGGCCATCTC	GGATCATCAG	AATATCGTCA	3960
CAAAGTTCCT	CAACATTGGT	CATGACATGG	TCAGAAAAGA	TAATGGTTGT	CCGCGCTCTT	4020



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TTTCCTGAAA AATGACTTGT TTGAGCAATT CTGTATTAAC TGGGTCCAAT CCACTAAAAG	4080
GCTCATCCAA GATAATCAGG TCTGGTTCAT GAATCAGAGT AATAATGAGC TGAATCTTCT	4140
GCTGATTTCC TTTTGACAGA CTCTTGATTT TATCTGTCAG CTTTCCTTTC ACTTCCAACC	4200
TCTTCATCCA TTGAGGGAGT TTTTCTTTGA CTTCTTTGGC ATCCATGCCT TTTAGAGTCG	4260
CCAAGTAGCG AACTTGTTCA AGAACTGTCA ATTTAGGCAT GAGATGCGTT CTTCAGGCAG	4320
ATAACCAATC CGAGCATAGG TCTCCTGACG AATATCCTGA CCATCCAGAC CGATTTCTCC	4380
CTGATATTCT AGGAATTCA AAATACTATG GAAAATCGTT GTTTTCCAG CACCATTTTT	4440
TCCGACTAGT CCCAAAATAC GACCTGGTCG CGCTTGAAAG TCAATACCA ACAAACCTTG	4500
CTTGATCCA AAACTTTCT CTAGACTTCT TACTTCTAGC ATCTTTCACC TCCGAAATTT	4560
CTTGACATCA TTATACTCCT TTTTGATAGC CTTTACAATG TTTTGTGCC ATTTTAGAA	4620
GACTATTGCT GTGTAAATA TGGCCTGGAG CACTTTTATA CTCAATGAAA ATCAAAGAGC	4680
AAACTAGGAA GCTAGCCGTA GACTGCTCAA AGTACAGCTT TGAGGTGCA GATAAACTG	4740
ACGAAGTCgA CTCAAAACAC TGTTTGAGG TTGTGGATAG AACTGACGAA kCrTAaCTAT	4800
ATCTACGGCA AGGCGAACTG ACGTGGTTTG AAGAGATTTT CGAAGAGTAT TAGTGATAAA	4860
TCCATTATAC AGCAGCAAAC TTAATTTATA CCTTCCGCTC CTCAACTGTC TATTTTAAAT	4920
CCTGAATTGT TATTTGAGTA ACTCCTTTT CCTCGTAAAG TTTCTTCCCT CTAAAACTTC	4980
TGGA AAAAGG CTAATAGTTT CAGACAACAT TTTTATAAGA AACAAGTTCA TCTGTCATTT	5040
CAAGAAGGAG TAATCCTTTA TCTACTAATG GACGGAACAG AATTCAACCG CTTGTCCGAT	5100
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TATATCTATT ATGCACACCC CTATAGGATC TAATGAAAAT CACAACAGGC TCATTCATAG	5280
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AAAGTAGATT AACAACTATC CTAAAAATG CTTGAACCTAC AAGTCCCCCA GAGAAGACTT	5400
CTGGATGACT AACTTGAAC TGAATTTAG CAATAATTAA TTCACTATCT AACTATATTT	5460
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AGCCATAAAT TACGTCCATC AGAGAGAGAC TCTTACTACT TTTAGATTTT AGTCTTTCTA	5580
GCTTCAGAAT ACATCTAAAC TTTAGGGAAA ATGACTATTC GAAAGCGCGA ATGCCTCAA	5640
ATTATCTCAG ATAAGCTATT CGAACTTAG AATGCTTTTA AATTTATGGA ATTGCGATTA	5700
TTCGAAACCT AGAATGCATA TAACCTTTAG TTGACAGACC TATTCTAAGT CTCGAAGGGC	5760

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TATTTACTTT CTATTCCTTA TCAAAAAAGA CTCATTCCCC CTTTCTCCTC CAAAATATGG	5820
TATAGTAGAA ATATACTATC TATGAGGAGT TTACATGTCA CAGGATAAAC AAATGAAAGC	5880
TGTTTCTCCC CTTCGTCAGC GAGTTATCAA TATCTCATCG ATTGTCGGTG GGGTTGGGAG	5940
TTTGATTTTC TGTATTTGGG CTTATCAGGC TGGGATTTTA CAATCCAAGG AAACCTCTC	6000
TGCCTTTATC CAGCAGGCAG GCATCTGGGG TCCACCTCTC TTTATCTTTT TACAGATTTT	6060
ACAGACTGTC GTCCCTATCA TTCCAGGGGC CTTGACCTCG GTGGCTGGGG TCTTTATCTA	6120
CGGGCACATC ATCGGACTA TCTACAATA TATCGGCATC GTGATTGGCT GTGCCATTAT	6180
CTTTTATCTA GTGGCCTAT ACGGAGCTGC CTTGTCCAG TCTGTCGTCA GCAAGCGCAC	6240
CTACACAAG TACATCGACT GGCTAGATAA GGGCAATCGT TTTGACCGCT TCTTTATTTT	6300
TATGATGATT TGGCCCATTA GCCCAGCTGA CTTTCTCTGT ATGCTGGCTG CCCTGACCAA	6360
GATGAGCTTC AAGCGCTACA TGACCATCAT CATTCTGACC AAACCTTTA CCCTCGTGGT	6420
TTATACCTAC GGTCTGACCT ATATTATTGA CTTTCTCTGG CAAATGCTT GACACGTAA	6480
AAATCCGTTT GGTTCCTCAA GTGGATTTT AAAGCGTAGA TTAATATAG CTTGATACTA	6540
AATATACTTT GGTATGAAA TCATGCATAT TTTTCGATAG TGAGGCGAGG ACTTACCTAG	6600
CCTTTCCGCC GTGATAGAAA CACCTGAAAT CTAATGGTT CAGGTATTCG GAAACTTTGA	6660
GCCTAGTGTC TCAAAGTTTA GGTATGGAAT TTTGAAGAAA GTCGCTACCG TCCGTAATCA	6720
CTTAAGGAAA GGCTCAAAA TATTGTTTTC AACCACAAA TCCGTTTGGT TTCCAAGCG	6780
GATTTTGTGC TTTATTTTGA AACTTCTTT GCAAGAACAA AGTTCCCAAG TGTGGCAGAA	6840
CCATTTCTTG CGACTGCTGG CGTCACGATA TAGTCACGCA CATCTGGTAC TGGTAGGTAA	6900
CCATTAAGAA GAGATGTAAA TTTCTCACGG ACACGGTCCA GCATATGTTG TTGAGCCATG	6960
ACCCCTCCAC CAAAGACAAT CACGTCTGGG CGGAAAGTCA CTGTGCGATT AACCGCAGCT	7020
TGAGCGATAT AGTAGGCTTG AACATCCCAA ACAGGGTTGT TGAGTTCAAT AGTTTCCCCA	7080
CGTACACCTG TACGAGCTTC CAAACTTGA CCAGCTGCAT AACCTTCTAG ACATCCCTTA	7140
TGGAAAGGAC AAACACCTT AAACCTTTT TCAATATCCA TTGGGTGTCT AGCAACATAA	7200
TAATGACCCA TTTTCAAGGTG ACCCACACCA CCGATAAACT CACCACGTTG GATGACGCTT	7260
GCACCGATAC CTGTACCGAT TGTGTAGTAA ACCAAGTTT CGATACGACC ACCAGCATTG	7320
TTACGGGCAA CCATTTTACC GTAAGCAGAG CTGTTTACGT CTGTTGTGAA GTACATTGGC	7380
ACGTTTAGGG CGCGACGAAG GGCACCAAGC AAGTCTACAT TTGCCAGTT TGGTTTGGGA	7440
GTCGTCGTGA TAAAGCCATA AGTTTGTGAG TTTTGTCAA TATCAATCGG CCCAAATGAA	7500
CCAAGTCAA GACCAGCAAG GTTATCGAAT TTTGAGAAGA ACTCAATGGT TTTATCGATT	7560

GTTTCGATG	GAGTTGTTGT	TGGAAATTGT	GTTTTTCTA	CAACGTAAA	GTTTTCATCA	7620
CCGACAGCAC	AGACAACTT	TGTACCGCCC	GCTTCCAAGC	TTCCATATA	TTTGTGTCATG	7680
ATAAACCTCT	TGTTTTTATT	TTCTTTATTA	TAGCATACTT	CGAAAGTCTA	AATGTCTCTA	7740
TTTTTTAGAT	TTTCCTCTGT	AAATCTTACT	ATCTAATAAA	AACGAACAAA	CATGTCAATT	7800
GTTTCGTTTC	ACATTAGAGA	GGATTGATTA	GATTTTCACT	TCGATCACAG	CATCCCCCTT	7860
AGCAACTGAA	CCTGTTGCGA	CTGGAGCTAC	TGAAGCGTAG	TCACCTGTAT	TTGTAACGAT	7920
AACCATTGTT	GTATCATCAA	GTCCAGCTGC	AGCGATTTTG	TTTGAGTCAA	ATGTTCCAAG	7980
AACATCGCCA	GCTTTCACCT	TATTACCTTG	AGCAACTTTT	GTTTCAAAAC	CGTCACCGTT	8040
CATAGATACA	GTATCAATAC	CAACATGAAT	CAAACTTCA	GCACCATTTT	TTGTTTTCAA	8100
ACCAAAAGCG	TGCCCTGTTG	GAAAGGCAAT	TGAACTTCA	GCATCAGCTG	GTGCATAGAC	8160
CACGCTTGG	CTTGGTTTCA	CAACGATACC	TTGTCCCAT	GCTCCACTTG	AGAAGACTGG	8220
GTCATTGACA	TCAGCAAGAG	CGACAACATC	ACCGACGATA	GGAGTTACAA	GTGTTTCATT	8280
TTGAAGAGCT	GCTGGCGCAA	CTTCTTCTTT	TTCTTCAGCC	ACTTCAGCTC	GTTTTCAGC	8340
TGCAGTTGCG	TCTACTTCAT	CTTCGTAACC	AAACATGTAA	GTAAGAGCAA	AACCAAGGGC	8400
AAATGATACA	GCTACCATAA	GAAGGTATG	TGGAAGTTGT	CCGTTACCAA	CATAAAGCAT	8460
TGTACCAGGG	ATGATGGTGA	TACCATTACC	AGTACCAGCA	AGTCCAAGGA	TAGAAGCCAA	8520
TCCACCACCG	ATTGCACCAG	CAATCAATGA	AAGGAAGAAT	GGTTTACGGA	AGCGCAAGTT	8580
CACCCCGAAG	ATAGCAGGCT	CTGTAATACC	TAGGAAGGCA	GAAAGAGCAG	CCGGGAAAGC	8640
AAGTGTTTTC	AGTTTTGGAT	TTTTTGTTTT	AACACCAACC	GCAACAGTAG	CAGCACCTTG	8700
AGCTGTCATA	GCAGCTGTGA	TGATAGCGTT	GAATGGGTTA	GCATGGTCAG	CAGCAAGTAA	8760
TTGCACTTCA	AGCAAGTTGA	AGATGTGGTG	CACACCTGAC	ACGACGATCA	ATTGGTGAAC	8820
CCCACCAATC	AAGAAACCAC	CAAGACCAA	TGGCATGCTA	AGAATCGCTT	TTGTAGCAAT	8880
AAGGATGTAG	TTTTCAACAA	CGTGAAAAC	TGGTCCAATG	ACAAAGAGTC	CAAGGATAGA	8940
CATGACCAAA	AGTGTACGGA	ATGGTGTAC	CAAGAGGTCA	ATGACATCTG	GAACAACTTG	9000
CGGACAGCTT	TTTCAAATTT	AGCTCCGACA	ACCCCGATGA	TGAAGGCTGG	AAGAACGGAA	9060
CCTTGCAAA	CAACAACAGG	GATGAAACCA	AAGAAGTTCA	TCGCTGTTAC	TTCAACACCT	9120
TGAGCAACTG	CCCAAGCGTT	TGGAAGTGAG	CCAGAGACAA	GCATCATACC	AAGAACGATA	9180
CCAACGGCAG	GATTTCCACC	AAATACACGG	AAGGTTGACC	ACACAACCAA	ACCTGGCAAG	9240
ATGATGAAGG	CTGTATCTGT	CAAGATTTGT	GTGTAAGTTG	CAAAGTCACC	TGGAAGTGGC	9300

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ATTTCAGAG CGTTGAAAAG ACCACGCACA CCCATGAAGA GACCTGTGCG TACGATAACT	9360
GGGATGATTG GAACGAAAAC ATCACCAAAA GTACGGATAG CACGTTGGAA CCAGTTCCTT	9420
TGTTTAGCAA CTTCTGCTTT CATGTCATCC TTAGATGATG TTGGTAATCC AAGTACAACA	9480
ACTTCATCGT ACATTTTGTT AACTGTACCT GTACCAAAGA TAATTTGGTA TTGCCCTGAG	9540
TTAAAGAAAG CACCTTGAAC TTTTCCAAG TTCTCAATCA CTTCTTTATT GATTTTCTCT	9600
TCATCTTTGA CCATGACACG TAGACGAGTC GCACAGTGGG CAACACTATT GACATTTTCA	9660
CGTCCGCCCA AGGCATCGAT GACTTTTTTT GCAATTTTCT GATTGTTTCAT TTGCAAAAAT	9720
CTCCTTATAT AACATTTTGT TCTTGTGTTGA AAGCGATTTT ATTCGCCGG	9769

(2) INFORMATION FOR SEQ ID NO: 31:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 3149 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 31:

CGCTTGAGTG CTAATTCATA GTTCTATTGT ATCACTTGGT CAGAAATAAT CAAGAAAAAA	60
GTCTGACTTT CTCAAGATAA AAAGCCTGAG ACCAACTCAG ACTTTTTAAT TCTTAAATG	120
GCAATTCCTC CTCTCCAAG ACCAAATCTG CCAAATCTTG GCCTGCATTA TTTTCACGCA	180
TAGCACGTTG GGCACGACTT TCCAAGAGTT GGAATCCTGT GACAAGTACT TCGGTCACGT	240
AGTTCATTTG GCCATTTTTC TCAAAGCGAC GGGTACGCAA TTCTCCATCA ACGGAAATGA	300
GACTACCTTT GGTGCGTAC TTGCCAAAGT TTCTGCTAGT CTGCCCCATA GGACCATATT	360
GACAAAATCA GCTTCACGTT CACCGTTTTG GTCTTTGTAA CGACGGTTCA CAGCGATAGT	420
TGCTCGCGCT ACCGACTTGT CATGTGTGGT TTTGTGCAAT TCTGGGTAG ACCTTAAACG	480
TCCAATCAAG ATAACTTTAT TATACATATT TTCTTCCTCC TACTTATCTA TTCGTAGGAA	540
ATCAAAAAAA GTTACAGAAA TTTGTAACCT TTCGAGAAAA TTTTTTATTT TTTATGAACC	600
ATGAAACCTG TCGCCTGTTG ATTGGCCATA ATGGTCATAT CTGTAATCTG AACACGACGA	660
GGTTGACTAG TCACATAGAC TACTGTATCT GCAATATCCT GAGCTTGCAA AGCTTCTATT	720
CCTTGGTAAA CGGACGCAGC TCGTTCTTTA TCACCATGAA AACGCACTGT AGAAAAATCT	780
GTTTCGACAA TTCCAGGCTG AATGGTCGTC ACCTTGATAT CCGTTGCGAT GGTATCAATT	840
CGCAGTCCAT CTGAAAAGGT CTTAACTGCC GCCTTGGTGG CTGAGTAAAC AGCTGCACCA	900
GCATAGGCAT AAATTCCTGC GGTGACCCC ATATTGATAA TATGACCTTG ATTGGCTTTT	960

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ACCATTGCTG GCAAGAAACA GCGAGTGACT GCCATCAAAC CTTTGACATT GGTATCCAAC	1020
ATGGTCAGCA TATCCAATC TTCATAGTCT TGATAGGGAG CTAAGCCAAG AGCCAGTCCT	1080
GCGTTATTGA CCAGGATGTC AATCTGACCT ATCGTTTCTA AAATATCAGA GCAGACAGTC	1140
TTTACCATTG TCATATCCGT GACATCTAGG AGAAAAGTCC AACTGTTTG ATTGGAAAA	1200
GTTTCTGCAA ACTCCGCCTT AAGAGCTTCT AGTCTGTCTA TCCGTCGTCC TGTAGAACG	1260
ACATCCTCAC CCTGCTCCAG ATAAGCACGC GCAATCGCTT CACCGATTCC TGATGTCGCT	1320
CCTGTAATCA CAACATTTT TGCCATCTTA TTTCCTTCTA GCTGGTCTAT CAGATATTAA	1380
CAACTTCTTA GGCAGTCCAG TGTTCGCTG GGTGCAACGG TGTCCGACA ACTTGGTCTT	1440
CTGATAATTC AAGCACCCCA CGTTTTGTG GAGCATTTGG CAGATGCAAT TCACGAGGAC	1500
TGCACATCAT ACCAAAATC TTTTCACCAC GAAGTTCACC TGGGAAAATG AGATTCCCTT	1560
TTGGCATCAT AGTCCAGGA AGCGCGACAA TGGTTTTCAA CCCCACACGC GCATTGGGAG	1620
CTCCTGCAAC GATTTGTACA GTCTTATCAC TTGCGACTGC AACTTGGCAG ATGTTGAGGT	1680
GGTCACTATC TGGATGGGCT ACCATCTCAA CAATTCACC TACAACAAAC TTAGGTTCTT	1740
TATCATTAAC AATTTCTTCT GTAAAACCTT CCGCCTGCAA CTCTTGGTTC AAACGAGCGA	1800
CTTGCTCATC TGTCAAAAAG ACTTGACCGC GCTCTGCAAT TTCAAATAAA CTTGAACTT	1860
CGAAAATATT CCAAGCCACT GTTCCCAT TATCTTTGAG AAAACACGG GCTACCTTGC	1920
CTTTGCGCTC CACATCCAGT TTGGCATCTC CGTATTTTT CACGATGACC ATAAGGACAT	1980
CACCGACATG TTCTTTATTA TATGTAAAA TCATTGTTTC CTTTTCTCC TATTTAGTC	2040
CTGCTAAAAA GTCATTGATT TGTGCTTGC TTTTACGGTC GCGATTGACA AAACGACCGA	2100
TTTCCTTGTG CTTTTCTAGA ACAACAAGGC TAGGAATTCC GTAAACATCC CAGAGTTTG	2160
CCAAATCCAT ATACTGATCT CGGTCCATTC GAATAAAGGT GAACTCTGGA TTGGTCTCCT	2220
CAATCTCTGG TAAGGCAGGA TAAATATAAC GACAATCGCT ACACCAGTCT GCCACAAAA	2280
TGAAGACCTT CTGCCCCGCT TTTTCCACTA AAGATGCTAA TTCTTCTAAA CTGCTGGCT	2340
GTATCATAAG ACTTCCTCCT CATAGACTAG GTCTTCATTT TCATAGACAA AGGTATAATG	2400
ACGGCCATCC TCAAAAATGA CGCCACCAAC CAAGCTCTCC AGACTGCTTT CGTAAACTTG	2460
AACATAAAGG GTCGCAATTT CCCCCATGTC GGAAAAATGG TCTCGACAA TCTCTGTCAA	2520
CTCTTCTGA GTCTTCATGA GCTTACGGTC ATCTGCAACT TTTTTCGTAG CAAGAGCAAG	2580
GCTTCCGATA CCTAGCAGAG CCAAGCCTGC CATCCACATT TTTTGTAGCTT TCATACCATT	2640
CATTTTAACA CAAAAAAGGC TTCAGGACAA ATGAGGAAGC AGCAGAAAAG CAAGTAAAA	2700

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GCCTCTTCCT TTAAGGAAAA GGACTTCTTA TACTCAATGA AAATCAAAGA CCAAAC TAGG	2760
AAGCTAGCCG CAGGCTGCTC AAAGCACTGC TTGAGGTTG TAGATAGAAC TGACGAgTCa	2820
CTCAAAACAC TGTTTTGAGG TTGTGGATGA AGCTGACGTG GTTTGAAGAG ATTTTCGAAG	2880
AGTATTATTC TTATTGCCAG GCACCTAAGT TGCCAACGTA GTAACATCA GGTGTGTAGG	2940
TATTGCGAGC ATCTTACCTG ATGAAGCCAG ATAATACTAC TTGCCATTGT CTTTGACCCA	3000
ATCATTGCGA ATCATGGAAC CAGAAGAACT TACATAATAC CATTCTCCCT TGTCATAAAC	3060
CCAAGTACTG ACTTTCATGG TTCCTGAGCA ATTAAAGGCA AAAAACTGT CCAATAACAT	3120
TCGTTTTTTA AAAGCATTG ACACTACAT	3149

(2) INFORMATION FOR SEQ ID NO: 32:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 10240 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 32:

CCAAAAATTC AACCTTTAAG GGGAGTCCAG AGAGACTCAC AAGGTGTCAG ATAAAAGAAT	60
GGTGCAATTT TCTAGAGGAG ACTTTTGTAG TGTGCTCTCT TGTGTTGTAC GATTTTAACT	120
GAGGCCTTGC ACTAGCAAGG TCTTTTCTTT ATCTGGTCCC CTTAAAATTT AAGGAGGAAA	180
AGTTATGAAT CCCACATGTA AGAAGCGTTT GGGTGTCATT CGGTTGGAAA CCATGAAGGT	240
GGTTGCACAA GAGGAAATCG CGCCACAATC TTTGAATTAG TCCTAGAAGG AGAAATGGTT	300
GAAGCCATGC GAGCAGGCCA ATTTCTTCAT CTGCGTGTAC CGGACGATGC CCATCTCTTA	360
CGTCGTCCTA TTTCAATTTT GTCTATTGAC AAGGCAAACA AGCAGTGTCA CCTCATTTAT	420
CGGATTGACG GAGCTGGGAC TGCAATTTTT TCAACCTTAA GTCAGGGAGA CACTCTTGAT	480
GTGATGGGGC CTCAGGGAAA TGGTTTTGAC TTGTCTGACC TTGATGAGCA GAATCAGGTT	540
CTCCTTGTTG GTGGTGGGAT TGGTGTCCA CCCTTGCTTG AGGTGGCCAA GGAATTGCAT	600
GAACGTGGAG TGAAAGTAGT GACAGTCCCT GGTTTTGCTA ATAAGGATGC TGTTATTTTG	660
AAAACGGAAT TGGCTCAGTA TGCTCAGGTC TTTGTAACGA CAGATGATGG TTCTTATGGC	720
ATCAAGGGAA ATGTTTCCGT TGTTATCAAT GATTTAGACA GTCAGTTTGA TGCTGTTTAC	780
TCGTGTGGGG CTCCAGGAAT GATGAAGTAT ATCAATCAAA CCTTTGATGA TCACCCAAGA	840
GCCTATTTAT CTCTGGAATC TCGTATGGCT TGTGGGATGG GAGCTTGCTA TGCTGTGTT	900
CTAAAAGTAC CAGAAAACGA GACCGTCAGC CAACGCGTCT GTGAAGATGG TCCTGTTTTT	960

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CGCACAGGAA CAGTTGTATT ATAAGGAGAA AATTATGACT ACAAATCGAT TACAAGTTTC	1020
TCTACCTGGT TTGGATTGGA AAAATCCGAT TATTCCAGCA TCAGGCTGTT TTGGCTTTGG	1080
ACAAGAGTAT GCCAAGTACT ATGATTAGA CCTTTTAGGT TCTATTATGA TCAAGGCGAC	1140
AACCCCTGAA CCACGTTTGG GGAATCCAAC TCCAAGAGTG GCAGAGACGC CTGCTGGTAT	1200
GCTCAATGCA ATTGGCTTGC AAAATCCTGG TTTAGAGGTT GTTTTGGCTG AAAAGCTACC	1260
TTGGCTGGAA AGAGAATATC CAAATCTTCC TATTATTGCC AATGTAGCTG GTTTTTCAAA	1320
ACAAGAGTAT GCAGCTGTTT CTCATGGGAT TTCCAAGGCA ACTAATGTAA AAGCTATCGA	1380
GCTCAATATT TCTTGTCCTA ATGTTGACCA CTGTAATCAT GGACTTTTGA TTGGTCAAGA	1440
TCCAGATTTG GCTTATGATG TGGTGAAAGC AGCTGTGGAA GCCTCAGAAG TGCCAGTTTA	1500
TGTCAAATTA ACCCCGAGTG TGACCGATAT CGTTACTGTC GCAAAAGCTG CAGAAGATGC	1560
GGGAGCAAGT GGCTTGACCA TGATCAATAC TCTGGTTGGA ATGCGCTTTG ACCTCAAAAC	1620
TAGAAAACCA ATCTTGCCCA ATGGAACAGG TGAATGTCT GTCCAGCAG TCTTTCCAGT	1680
AGCCCTCAAA CTCATCCGCC AAGTTGCCCA AACAACAGAC CTGCCTATCA TTGGAATGGG	1740
AGGAGTGGAT TCGGCTGAAG CTGCCCTAGA AATGTATCTG GCTGGGCGAT CTGCTATCGG	1800
AGTTGGAACA GCTAACTTTA CCAATCCTTA TGCCTGCCCT GACATCATCG AAAATTTACC	1860
AAAAGTCATG GATAAATACG GTATTAGCAG TCTGGAAGAA CTCCTGCAGG AAGTAAAAGA	1920
GTCTCTGAGG TAAACTGCAA TCAATCTGTT CTTGATTTT TATTAGTTTG TAATATGAAT	1980
TTAGGAGAAT TTTGGTACAA TAAATAAAT AAGAACAGAG GAAGAAGGTT AATGAAGAAA	2040
GTAAGATTTA TTTTTTTAGC TCTGCTATTT TTCTTAGCTA GTCCAGAGGG TGCAATGGCT	2100
AGTGATGGTA CTTGGCAAGG AAAACAGTAT CTGAAAGAAG ATGGCAGTCA AGCAGCAAAT	2160
GAGTGGGTTT TTGATACTCA TTATCAATCT TGGTCTATA TAAAAGCAGA TGCTAACTAT	2220
GCTGAAAATG AATGGCTAAA GCAAGGTGAC GACTATTTTT ACCTCAAATC TGGTGGCTAT	2280
ATGGCCAAAT CAGAATGGGT AGAAGACAAG GGAGCCTTTT ATTATCTTGA CCAAGATGGA	2340
AAGATGAAAA GAAATGCTTG GGTAGGAAT TCCTATGTTG GTGCAACAGG TGCCAAAAGTA	2400
ATAGAAGACT GGGTCTATGA TTCTCAATAC GATGCTTGGT TTTATATCAA AGCAGATGGA	2460
CAGCACGCAG AGAAAGAATG GCTCCAAAT AAAGGGAAGG ACTATTATTT CAAATCCGGT	2520
GGTTATCTAC TGACAAGTCA GTGGATTAAT CAAGCTTATG TGAATGCTAG TGGTGCCAAA	2580
GTACAGCAAG GTTGGCTTTT TGACAAACAA TACCAATCTT GGTTTTACAT CAAAGAAAAT	2640
GGAAACTATG CTGATAAAGA ATGGATTTTC GAGAATGGTC ACTATTATTA TCTAAAATCC	2700

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GGTGGyTACA TGGCAGCCAA TGAATGGATT TGGGATAAGG AATCTTGGTT TTATCTCAAA	2760
TyTGATGGGA AAATrGCTGA AAAAGAATGG GTCTACGATT CTCATAGTCA AGCTTGGTAC	2820
TACTTCAAAT CCGGTGGTTA CATGACAGCC AATGAATGGA TTGGGATAA GGAATCTTGG	2880
TTTTACCTCA AATCTGATGG GAAAATAGCT GAAAAAGAAT GGGTCTACGA TTCTCATAGT	2940
CAAGCTTGGT ACTACTTCAA ATCTGGTGGC TACATGGCGA AAAATGAGAC AGTAGATGGT	3000
TATCAGCTTG GAAGCGATGG TAAATGGCTT GGAGGAAAA CTACAAATGA AAATGCTGCT	3060
TACTATCAAG TAGTGCCTGT TACAGCCAAT GTTTATGATT CAGATGGTGA AAAGCTTTCC	3120
TATATATCGC AAGGTAGTGT CGTATGGCTA GATAAGGATA GAAAAAGTGA TGACAAGCGC	3180
TTGGCTATTA CTATTCTGG TTTGTCAAGC TATATGAAAA CAGAAGATT ACAAGCGCTA	3240
GATGCTAGTA AGGACTTTAT CCCTTATTAT GAGAGTGATG GCCACCGTTT TTATCACTAT	3300
GTGGCTCAGA ATGCTAGTAT CCCAGTAGCT TCTCATCTTT CTGATATGGA AGTAGGCAAG	3360
AAATATTATT CGGCAGATGG CCTGCATTTT GATGGTTTTA AGCTTGAGAA TCCCTTCCTT	3420
TTCAAAGATT TAACAGAGGC TACAACTAC AGTGCTGAAG AATTGGATAA GGTATTTAGT	3480
TTGCTAAACA TTAACAATAG CCTTTTGGAG AACAGGGCG CTACTTTTAA GGAAGCCGAA	3540
GAACATTACC ATATCAATGC TCTTTATCTC CTTGCCCATTA GTGCCCTAGA AAGTAACTGG	3600
GGAAGAAGTA AAATTGCCAA AGATAAGAAT AATTTCTTTG GCATTACAGC CTATGATACG	3660
ACCCCTTACC TTTCTGCTAA GACATTTGAT GATGTGGATA AGGGAATTTT AGGTGCAACC	3720
AAGTGGATTA AGGAAAATTA TATCGATAGG GGAAGAACTT TCCTTGGAAG CAAGGCTTCT	3780
GGTATGAATG TGGAATATGC TTCAGACCCT TATTGGGGCG AAAAAATGC TAGTGTGATG	3840
ATGAAAATCA ATGAGAAGCT AGGTGGCAAA GATTAGTACT ATAAGTGAAT ATGATTTGAG	3900
TGAATAGTAA GTTAAAAATC CTGATTTCAA GTAAAAATCAG GATTTTTTCA TGGATGCAAT	3960
TTTTTTGGAG TCTGGTGTA CGCGGAGGCT CTTTGTCTCT GTGTAAGTGA CAAAGCCGGG	4020
TTTTCCACCA GTTGGTTTAT TGAGTTTTTT GACTTCAATC ATATCTACCT GCACCAGATT	4080
CGACAGGCGC CCTTGAGAGA AGTAGGCAGC TAACTCTGCT GCGTCTGTCT TGAATGCATC	4140
AGATGGGTCA AGATTTCCCTG AGATGACAAC ATGGCTTCCA GGAATGTCCT TAGCATGGAA	4200
CCAAAGTTCC TCCTTGCGGG CCATTTTAAA GGTCAATTCC TCATTTTGAA GATTGTTTCG	4260
TCCGACATAG ATGATGGTTT TGCCATCGCT TGCTAGATAT TGTTCATGTT TTTTGCGTTT	4320
CTGGATTTTC TCCCGTTGTC TTCTGCGGAT AAAACCTGTT TGAATCAATT CTTACGGAT	4380
TTCAGCGATT TCTTCCAGTC CAGCTTGCTT GAGGACGGTT TCTACACTTT CCAGATAGAG	4440
AATAGTGGCT TTGGTTTCTT CAATCAAATC AGTCAAGTAT TTGACAGCTT CTTTGAGTTT	4500



CTGATACCGT TTAAATAGC GTTGGGCATT CTGGTTGGGA GTCAGAGCCT TATCAAGCGC	4560
AATCATGATA GGTGGTTGG TATAGTAGTT GTCTAGGATA ACCTGGTCTT GGTCGTTAGG	4620
CACTTGGTGG AGGAAGSTG TCAGCAATTC TCCTTTTGA CGAAATTCCT CAGCGTTGTC	4680
TGTCGCCAGT AACTCTTTT CCTGTTTTT GAGTTTGTGT CGGTTTTCTT GAAGTTCATT	4740
TTCAACACGA CGAATCAGTT CACTGGCCTG CTGTTTGACG CGGTCGCGCT CAGCCTTATC	4800
CTTATAGTAG GTGTCCAACA AATCAGAAAG ATTTGCAAAA GGCTCTCCCA CCTGATTTGC	4860
AAAAGGAACT GGACTGAAGG AAGTCTCAGT CAAGCATGGC TTGGTTTCTT GATTGAAAAA	4920
ATTTCCGAAA GCGGAAAGTT TTTCACAAAC CAGTATCCTT TCCAATTCAT TTGCCGTATC	4980
GCGTCCAGA CCTTGAAAGA GGCTTTGAAG ATTTTGTGCT GTTAGTTCTT GGGTTTGACG	5040
GATTTCAAAG AGCTTTTCAT CCTTGATAGT AAAAGGATTG AGAGATTTTG TACTTGCGCG	5100
AGCGATATAG GTCGATCCTG GAAGTAAGGT GCGGTAGCTA TTTTGTGAAA AGCCGACGTG	5160
TTTGATAACT TCGAGGATTT TATGACTGCT TTTATCGACC AGTAGAATAT TACTGTGTTT	5220
CCCCATAATT TCGATAATCA AGGTAGCCTG GATATGGTCT CCAATCTCGT TTTTATTGGA	5280
AACTGTAATT TCCACAATAC GGTCATTTTC CACTTGCTCA ATCGACTCAA TCAGGGCCCC	5340
CTGCAAAATC TTTCTCAAAA CCATGATAAA GGTAGAAGGT TGAGCTGGAT TTTCAAAAGT	5400
CGTTTGGGTC AGCTGAATGC GTCCAAAAAC TGGATGGGCA GAAAGGAGCA GGCGATGGCT	5460
TTGGCGATTG CTGCGGATTT GCAAGACCAA CTCTTGTTCA AAAGGCTGAT TGATTTTCTG	5520
GATGCGACCA TTCACTAATT CGCTTCGCAA TTCCTCAACT ATGTGGTGTA AAAAAATCC	5580
GTCAAATGAC ATCGTTCTCT CCTTGTGATT GTATTCCATA GTATTATATC AAAAAGGTAG	5640
AATAAATCA TGGAAATGTG GTATAATAAA GCCAAGTAAA GAGAAACGAG AAGCACATGT	5700
ATATTGAAAT GGTAGATGAA ACTGGTCAAG TTTCAAAAGA AATGTTGCAA CAAACCCAAG	5760
AAATTTTGA ATTTGCAGCC CAAAAATTAG GAAAAGAAGA CAAGGAGATG GCAGTCACTT	5820
TTGTGACCAA TGAGCGTAGT CATGAACTTA ATCTGGAGTA CCGTAACACC GACCGTCCGA	5880
CAGATGTCAT CAGCCTTGAG TATAAACAG AATTGGAAAT TGCCTTTGAC GAAGAGGATT	5940
TGCTTGAAAA TTCAGAAATG GCAGAGATGA TGTCTGAGTT TGATGCCTAT ATTGGGGAAT	6000
TGTTCACTC TATCGATAAG GCTCATGAGC AGGCCGAAGA ATATGGTCAC AGCTTTGAGC	6060
GTGAGATGGG CTTCCTGGCA GTACACGGCT TTTTACATAT TAACGGCTAT GATCACTACA	6120
CTCCGAAGA AGAAGCGGAG ATGTTCCGTT TACAAGAAGA AATTTTGACA GCCTATGGAC	6180
TCACAAGACA ATAAACGAAA ATGGAAAAAT CGTGACTTGA TATCCAGTTT AGAATTGCT	6240

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TTGACAGGTA TTTTACTGCG TATCAAGGAA GAACGCAATA TGCGAAAACA CGCAGTGACG	6300
GCTCTAGTGG TCATCCTTGC AGGTTTGTGTT TTTCAGGTGT CACGAATCGA ATGGCTCTTT	6360
CTCCTATTGA GTATTTTCTT GGTAGTAGCC TTGAGATTGA TCAACTCTGC TATTGAAAAT	6420
GTGGTGGATT TGGCCAGTCA CTATCACTTT TCCATGCTGG CTAAAAATGC CAAGGATATG	6480
GCGGCCGCG CGGTATTAGT GGTTTCTCTT TTCGCAGCCT TAACAGGCGC ATTGATTTTT	6540
CTCCACGAA TCTGGGATT ATTATTTTAA ACAGTAAGAG GAAATTATGA CTTTAAATC	6600
AGGCTTTGTA GCCATTTTAG GACGTCCCAA TGTGGGAAG TCAACCTTTT TAAATCACGT	6660
TATGGGGCAA AAGATTGCCA TCATGAGTGA CAAGGCGCAG ACAACGCGCA ATAAATCAT	6720
GGGAATTTAC ACGACTGATA AGGAGCAAAT TGTCTTTATC GACACACCAG GGATTCACAA	6780
GCCTAAAACA GCTCTCGGAG ATTTTCATGGT TGAGTCTGCC TACAGTACCC TTCGCGAAGT	6840
GGACACTGTT CTTTTCATGG TGCCCTGCTGA TGAAGCGCGT GGTAAGGGGG ACGATATGAT	6900
TATCGAGCGT CTCAAGGCTG CCAAGGTTC TGTGATTTTG GTGGTGAATA AAATCGATAA	6960
GGTCCATCCA GACCAGCTCT TGTCTCAGAT TGATGACTTC CGTAATCAAA TGGACTTTAA	7020
GGAAATTGTT CCAATCTCAG CCCTTCAGGG AAATAACGTG TCTCGTCTAG TGGATATTTT	7080
GAGTGAAAAT CTGGATGAAG GTTTCCTAATA TTTCCCGTCT GATCAAAATCA CAGACCATCC	7140
AGAAGCTTTC TTGGTTTCAG AAATGGTTCG CGAGAAAGTC TTGCACCTAA CTCGTGAAGA	7200
GATTCCGCAT TCTGTAGCAG TAGTTGTGA CTCTATGAAA CGAGACGAAG AGACAGACAA	7260
GGTTCACATC CGTGCAACCA TCATGGTCTGA GCGCGATAGC CAAAAAGGGA TTATCATCGG	7320
TAAAGGTGGC GCTATGCTTA AGAAAATCGG TAGCATGGCC CGTCGTGATA TCGAACTCAT	7380
GCTAGGAGAC AAGGTCTTCC TAGAAACCTG GGTCAAGGTC AAGAAAAACT GGC GCGATAA	7440
AAAGCTAGAT TTGGCTGACT TTGGCTATAA TGAAAGAGAA TACTAAGTAG AGGTAGGCTC	7500
ATGCCTGCTT CTTGTTTTTA CAGAAGGAGG ACTTATGCCT GAATTACCTG AGGTTGAAAC	7560
CGTTTGTCTG GGCTTAGAAA AATTGATTAT AGGAAAGAAG ATTCGAGTA TAGAAATTCG	7620
CTACCCCAAG ATGATTAAAG CGGATTTGGA AGAGTTTCAA AGGGAATTGC CTAGTCAGAT	7680
TATCGAGTCA ATGGGACGTC GTGGAAAATA TTGCTTTTTT TATCTGACAG ACAAGGTCTT	7740
GATTTCCCAT TTGCGGATGG AGGGCAAGTA TTTTACTAT CCAGACCAAG GACCTGAACG	7800
CAAGCATGCC CATGTTTCTT TTCATTTTGA AGATGGTGGC ACGCTTGTTT ATGAGGATGT	7860
TCGCAAGTTT GGAACCATGG AACTCTTGGT GCCTGACCTT TTAGACGTCT ACTTTATTTT	7920
TAAAAAATTA GGTCTGAAC CAAGCGAACA AGACTTTGAT TTACAGGTCT TTCAATCTGC	7980
CCTTGCCAAG TCCAAAAAGC CTATCAAATC CCATCTCCTA GACCAGACCT TGGTAGCTGG	8040

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ACTTGGCAAT ATCTATGTGG ATGAGGTTCT CTGGCGAGCT CAGGTTTCATC CAGCTAGACC	8100
TTCCCAGACT TTGACAGCAG AAGAAGCGAC TGCCATTTCAT GACCAGACCA TTGCTGTTTT	8160
GGGCCAGGCT GTTGAAAAAG GTGGCTCCAC CATTTCGACT TATACCAATG CCTTTGGGGA	8220
AGATGGAAGC ATGCAGGACT TTCATCAGGT CTATGATAAG ACTGGTCAAG AATGTGTACG	8280
CTGTGGTACC ATCATTGAGA AAATTCAACT AGGCGGACGT GGAACCCACT TTTGTCCAAA	8340
CTGTCAAAGG AGGGACTGAT GGGAAAAATC ATCGGAATCA CTGGGGGAAT TGCCTCTGGT	8400
AAGTCAACTG TGACAAATTT TCTAAGACAG CAAGGCTTTC AAGTAGTGGG TGCCGACGCA	8460
GTCGTCCACC AACTACAGAA ACCTGGTGGT CGTCTGTTTG AGGCTCTAGT ACAGCACTTT	8520
GGGCAAGAAA TCATTCTTGA AAACGAGAGAA CTCAATCGCC CTCTCCTAGC TAGTCTCATC	8580
TTTTCAAATC CTGATGAACG AGAATGGTCT AAGCAAATTC AAGGGGAGAT TATCCGTGAG	8640
GAAGTGGCTA CTTTGAGAGA ACAGTTGGCT CAGACAGAAG AGATTTTCTT CATGGATATT	8700
CCCCTACTTT TTGAGCAGGA CTACAGCGAT TGGTTTGCTG AGACTTGGT GGTCTATGTG	8760
GACCGAGATG CCCAAGTGGG ACGCTTAATG AAAAGGGACC AGTTGTCCAA AGATGAAGCT	8820
GAGTCTCGTC TGCGAGCCCA GTGGCCTTTA GAAAAAAGA AAGATTTGGC CAGCCAGGTT	8880
CTTGATAATA ATGGCAATCA GAACGAGCTT CTTAATCAAG TGCATATCCT TCTTGAGGGA	8940
GGTAGGCAAG ATGACAGAGA TTAAGTGGAA GGATAATCTG CGCATTGCCT GGTTTGGTAA	9000
TTTTCTGACA GGAGCCAGTA TTTCTTTGGT TGTACCTTTT ATGCCCATCT TCGTGGAATA	9060
TCTAGGTGTA GGGAGTCAGC AAGTCGCTTT TTATGCAGGC TTAGCAATTT CTGTCTCTGC	9120
TATTTCCGCG GCGCTCTTTT CTCCTATTTG GGGTATTCTT GCTGACAAAT ACGGCCGAAA	9180
ACCCATGATG ATTCGGGCAG GTCTTGCTAT GACTATCACT ATGGGAGGCT TGGCCTTTGT	9240
CCCAAATATC TATTTGGTTAA TCTTTCTTCG TTTACTAAAC GGTGTATTTG CAGGTTTGT	9300
TCCTAATGCA ACGGCACTGA TAGCCAGTCA GGTTCCAAAG GAGAAATCAG GCTCTGCCTT	9360
AGGTACTTTG TCTACAGGCG TAGTTGCAGG TACTCTAACT GGTCCCTTTA TTGGTGGCTT	9420
TATCGCAGAA TTATTTGGCA TTCGTACAGT TTTCTTACTG GTTGGTAGTT TTCTATTTTT	9480
AGCTGCTATT TTGACTATTT GCTTTATCAA GGAAGATTTT CAACCACTAG CCAAGGAAAA	9540
GGCTATTCCA ACAAAGGAAT TATTTACCTC GGTTAAATAT CCCTATCTTT TGCTCAATCT	9600
CTTTTAAACC AGTTTGTGCA TCCAATTTTC AGCTCAATCG ATTGGCCCTA TTTTGGCTCT	9660
TTATGTACGC GACTTAGGGC AGACAGAGAA TCTTCTTTT GTCTCTGGTT TGATTGTGTC	9720
CAGTATGGGC TTTTCCAGCA TGATGAGTGC AGGAGTCATG GGCAAGCTAG GTGACAAGGT	9780

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GGGCAATCAT CGTCTCTTGG TTGTCGCCCA GTTTTATTCA GTCATCATCT ATCTCCTCTG	9840
TGCCAATGCC TCTAGCCCCC TTCAACTAGG ACTCTATCGT TTCTCTTTG GATTGGGAAC	9900
CGGTGCCTTG ATTCCCGGGG TTAATGCCCT ACTCAGCAA ATGACTCCCA AAGCCGGCAT	9960
TTGAGGGTC TTTGCCTTCA ATCAGGTATT CTTTATCTG GGAGGTGTTG TTGGTCCCAT	10020
GGCAGGTTCT GCAGTAGCAG GTCAATTTGG CTACCATGCT GTCTTTTATG CGACAAGCCT	10080
TTGTGTTGCC TTAGTTGTC TCTTAACTT GATTCAATT CGAACATTAT TAAAAGTAA	10140
GGAAATCTAG TGCAGTAAA AATCAATCTC AAATGCTCCT CTTGTGGCAG TATCAATTAC	10200
CTAACCAGTA AAAATTCAAA AACCCATCCA GACAgATTGA	10240

(2) INFORMATION FOR SEQ ID NO: 33:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 13206 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 33:

CGCTTTATCG TGGACGTGGT CAAGCCGAGA ATTTTCATCAA GGAGATGAAG GAGGGATTTT	60
TTGGCGATAA AACGGATAGT TCAACCTTAA TCAAAAACGA AGTTCGTATG ATGATGAGCT	120
GTATCGCCTA CAATCTCTAT CTTTCTCTCA AACATCTAGC TGGAGGTGAC TTCCAACTT	180
TAACAATCAA ACGCTTCCGC CATCTTTTTC TTCACGTGGT GGGAAAATGT GTTCGAACAG	240
GACGCAAGCA GCTCCTCAA TTGTCTAGTC TCTATGCCTA TTCCGAATTG TTTTCAGCAC	300
TTTATCTAG GATTAGAAAA GTCAACCTGA ATCTTCCTGT TCCTTATGAA CCACCTAGAA	360
GAAAAGCGTC GTTAATGATG CATTAAAGAA CAGTCGAGAT GAAAAAATCG TGTGACGCAC	420
CAAGGGAGGA GTCTGCCCTT TTGAGGAAAT CTAGCGAGGA AAAACGATAC TGAACAGCA	480
GAAAGTAAAA CTGACCTCAT GAGGAGGAAG AAAGTGGCTC ATGAGGTCAG GGGTTTGTAA	540
AGTTACATCT AGTTGAGAGA GGTATGAATG ATTTGGGATT AATCATTTCT TGTTTTAAAT	600
CAGGAGAATA GTAACGATTT TTCTCTTTT TGACGAACTC TATTCGTAA CGATCAATCA	660
ATTTAATCAT GTACCTAATA TTAGAATTGT TTATCCCAA TTTATTTGAA AGCTTCTCTA	720
AGCTATATCC TTGTTTCTA AGTTCATAGA TCTGAACTTT ATCATCATAA GTTAGTTTCA	780
TAATAAAAAC ACCCCAAAAG TTAGATTTT TCTGTCTAAC TTTTGGGGG CAGTTCATTC	840
AACACCTGAT ACTATGCGTT TTTCTTATTT GAAATACTTT TTAACAACC TCTTTATACT	900
CAATGAAAT CAAAGTGCAA ACTAGAAAGC TAGCCTCAGG CTGCTCAAAA CAGTGTTTTG	960

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AGGTTGCAGA TGGAAGCTGA CGTGGTTTGA AGAGATTTTC GAAGAGTATT ACTTAATCTT	1020
CTTGATACTT TGAATAAGAA TAAATCCTAC AATCATCCCT ACCATATTTT GCATAAAATT	1080
CGGTAGAATT TCTGGGAGGG CTGCTGCCCA GCCATTTCATC AAAGCAGAAC CCAAGGCGTA	1140
GCCTCCTACC ATGGCAATAG TTGCTAAAAT AAGGCCTAAC CACTGACTTT TTCCTTTAAA	1200
TCCTGCGAAA AATCCCTGCA AGCCATGGTT GACCAAGCTA AAGAACATCC ACTGAGGGTA	1260
GCCTGATAAG AGGTCAATCA AGAACTTGC TAGTCCTCCG ACTACCGCTC CTTACGACT	1320
ACCAAAGTAA AAGGCCGCAA AGAAGACACC AGCATCTAAA AGAGTTAGAA TTCCTGTAGG	1380
TGTTGGGATT TTTAAGAAAT AACCTAGAAC CACAGAAAGG GCGGTTAATA GGGATACAAG	1440
GGCGATTTTA GTTGTMTTGT TTTGCTTCAT ATTGTCTTAC TCCATACTGA TCTGCTTGTG	1500
CAATAGCACG ATAAACGAAA GCCTTAGAGC TTTCTACTGC TGGCAAAAGT TTATCACCTT	1560
TAACCAAGTG ACTGGCAATG CTAGAGSCAA AGGTACAACs TGCACCAGCA TTTTGGCCTT	1620
GGATAACTGG ATTTTCTAGG ATAGTAAAGG TCTGTCCATC ATAAAAGACA TCCACAGCCT	1680
TGTCCTGACT AAGACGATTG CCTCCCTTGA TAATGACTGt GCGCCTCCTA AATCATGCAA	1740
TTTCTGCGCT GCAGTTTCA TGTCTTCCAA GGTMTTAAAT TCCTGACCGG ATAATAATTC	1800
TGCTTCTGGG AGATTAGGCG TAATCACACT GACATAAGGG AAAAAGCGAA TCAACTCTTG	1860
GCAGAGCTCA CTGACAGCTA CATCATGCGT TTCCTTGCAg ACCAAGACAG GATCCAACAC	1920
CACAGTACT CCTGGGCGTT GTTTGATAAA GTCCAAGGCC TTCTCAGCCA CGCTGACAGT	1980
AGGGAGAAGA CCAATCTTAA TTCCCCCAA TTCCACATCA CGCAAGCTAT CTAATTCATG	2040
TTGAAAAATG GTATCATCAG TTGGAAAGAC TTCAAATCCT TTTTCTGTCA AGGCTGTCAA	2100
ACAAGTCACT GCTACAAACC CATGCAAGCC GTTCAAGGTA TAGGTAGCCA AATCAGCTGA	2160
CAGTCCACCA CCACTAAAAA TATCATTTCC AGAAAGTGCT AAAATACGAT TATTCTTCAT	2220
AACGAATCTC CTTTAAATAC AAACCATTTG GTGCTGCAGT GGGACCTGCA AGTTGCCTGT	2280
CCTTCTTCTC CAAGATGAGA TCAATCTGCT CTACTGGCAT GCGGTTGTTA CCGATTTTGA	2340
GAAGAGTCCC CACCATATTG CGAATCTGTT TATACAAGAA ACCATTTCTT GAAAAGGTAA	2400
AGGTCAAAAA TTGTCCTGTC TCATCGACTA TTAAACTAGC TTCTGTGATG GTGCGAACCT	2460
TATCCTCTAC ACTAGTCCCA GAGGCTGTAA AACCAGTAAA ATCATGGGTT CCCTCTAGCT	2520
TTTTGATTGC AATCTGCATT CGTTCCACAT CGAGTGGGTA GGGAAAGTGG GTGGCATAGT	2580
GACGGCGCAT CGGATTTTGT GGACGTCCTC TATCCACAGT AAACCTCATAG GTCTTGCTAT	2640
GCTTGGCATA ACGGCAATGA AAATCATCTG CCACAAGCTC AATCGAAATC ACATCAATAT	2700

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CTTCAGGAGA CTGGGTATCC AAGGCAAAAC GGAGTTTCTC CTCATCCATC TGATAAGGCA	2760
GGTCAAAATG AATCACCTGT CCCAGGGCAT GAACCCCACT ATCTGTCCTA CCAGCACCGT	2820
GAACAGTAAT GGCTTGCCCT TTATTTAATC TGGTCAAGGT TTTTCAATT TCTTCCTGAA	2880
CGCTACGCGC ATGAGGCTGG CGCTGAAAGC CAGCAAAGGC ATAACCATCA TAGGAAATAG	2940
TTGCTTTATA TCTCGTCATA GCCTCTATT TATCAAGAAA TTAGTCTGTA AACAAAGACC	3000
TAAACAAAT ATTGTATGGG TATAAAATC TCATACTCTT CGAAATCTC TTCAAACCAC	3060
GTCAGTTTCC ATCTGCAACC TCAACACACT ATTTTGAGCA ACCTGCGGCT AGCTTTCTAT	3120
AGTAGATTGA AATAAGATAT GAACAACTCT ATTAGGAAAG TCAAATTAAT TTCTAGAAAT	3180
ATTTTAGCAG CTACAGCGTA CTATTCCAAA CTCATCAAC TATAGTTTGC TCTTTGATTT	3240
TCATTGAGTA TCAAAAGAAA AACTTAGGAA TCAATCCTAA GCTCTCTTCT GAAGTAGGTA	3300
CATGACAAAG ATAGAGATTA CAATCAACCA ACCTCCTAAG ATACTAAAGA CCAACATCCC	3360
ATTGTGAGTT AGTAAGCCAA TTGCACCTAG AACGAATGGG GTCGTAAAGG CTCCGAAACT	3420
ACAGCCTAAT ACAGCAAATG AAGTTGCTTG ATTGAGGAGT TTAGCTGGAA TTCGTTGAGA	3480
GACAAGTTGA AAGACCGTCG TCAAGACTAC ACTATAGGCA AATCCAGCCA GAACACTTCC	3540
TGCTACTACC ACCCACAAGG ATGAAGACAA GGCAATCAGG ATTTGCCCCA AGCCAAAGGT	3600
AATACCAGAC CAGAGGAGCA GTTCTCTTTT AAAGATAGAA ATCAAGAAAG AAAAATCAC	3660
CCCAGCCACA ATCCCCATCA ACTGCATGAT ACTAAGAAAC AAAGTAGATA ACTGGGCATC	3720
CCCCAATCCT CTTTCCACCA TCAAACCTGG AATACGGATG GTAATAGCTG TATTGGTACA	3780
AACTACAAC TCGCGTTTGA TAGCTAAGGT AAAAATCAAG CCTTTCATTT CTCGAGTTAA	3840
ACGACTTGCT TCCTTCGCTC TTTCTTGAC TTCTTTCTTT GATTTTCCAT AAGGGACAAA	3900
GAGCAGATAA AGGGGAGCA CCAAAAATCC AGCACTATAG GCTAGAAAGA TAGCTGTCCA	3960
ACCAAAGGCC AACAACTGAC CGACGGCCAA GGTAATGAGA GAAGCTCCAA CGACCTCTGC	4020
AGAAGCGCGT AGCCCTAACA TCTGAATTCG CCTTTTTCCT TGGTAGCGTT CACTGATAAT	4080
AGAAATGGCC TTGGCATTGA TCATCCCAAG ACCCAAACCA AAGAGAAGCC GTGTTCAAA	4140
GACAAAGGGA TAGGCTTGGT ACCAGAAGG AGCTGTACCG CTCATGATA AAATCAGCAA	4200
GCCCAAACTA ATCTGTAAGC GCTCAGGAAA TATTTTCTTCT AAGAAACCAT TTAGCAGTAA	4260
CATCATCATG ATTCCAAAGG AAGGCAAGCT CACCAAGAGC TCAATTTGTT CCTTAGAATA	4320
ACCCTGATAA TAGTCAAACA TGGCTGGTAG GGCACCTGAA ATGGAAAAGG AGGTAATCAA	4380
AACGAGGGAG AGAGCCAAAA TGCTGGCCCG TTCTAAAAAT TGTTTCATGA AATCTCTTTC	4440
TATATTTCTC TTAATCTTCT ACTTTTTTGA TAGTTATCAA ATAAGCAAGA AAAGAAGAAG	4500

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CCTCATTTGGT TTGTAGACTC CTTCTTAAAT TCGAAAATGA ATCCCTTGTA TCTTATACTC	4560
AATGAAAATC AAAGAGCAAA CTAGGAAGCT AGCCGCAGGT TGTTCAAAAC AGTGTTTTGA	4620
GGTTGCAGAT GGAAACTGAC GTGGTTTGAA GAGATTTTCG AAGAGTATTA GGATGACTTT	4680
CTCTTGATTT GCTTGATAAA GTAGAAAATA AATCCTGCTA CCATATAGGC AACAAAGATA	4740
ATCAGACACC ACTTAAACAC AACATTCCAA CCCTTGTTCA CATTCAAAA GAAGTAAGGG	4800
AAAGGATTAT CCTTGGCATT TGAATATTG AGTTTGTAGAA CCAAGCCATT AAAAGAGCA	4860
AACATCATAT ACAGAAAGGG TAAATGGTC CACACTGCTG GATCCCAAAT CTTGTATTGA	4920
CCCTGTTTGT CAAAAAGAG GGTATCCGCT AAAAACCAGA TGGGAACGAT ATAGTGGCAA	4980
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ACACAGGTAA TCATGATACT CATGGTGACC CCACCTTTTA AGCGCAAGAG ACTTGGCCTT	5100
TGCCAATTTT CACCTACAG GCTCATAACC TTTAGAAGAT AAAGGTAAA AATAGTTACC	5160
AAGAGTTGG ACAGAACCGT GTAATAGAGA AGCATCCCAA AACCACCATG CTTAGTAATT	5220
TCAAGATAAA CTCCCGTAAA AGCCGCTAGA AACAAGAAGA TACGGCTATA AAATACAAGT	5280
TTATAGTGTT TTGACATGCT TAAATCTTCC TCACAACTC TGATTTAAGT TTCATGGCAC	5340
CAAAACCATC AATCTTACAG TCGATATTGT GGTGCGCTTC TACGATGCGG ATATTTTCA	5400
CGCGCGTCCC TTGTTTCAAA TCTTTTGGCG CACCTTTTAC TTTCAAGTCC TTGATGAGAG	5460
TTACTGTATC ACCATCAGCC AATTTATTTT CGTTGGCATC GATAGCGACA AGACCTTCTT	5520
CTACTTCTGC AACTTCAGCA GGATTCCACT CATGAGCACA CTCTGGGCAA ACCAGTAGGG	5580
CACCGTCTTC GTAGACATAC TCTGAGTTAC ATTTTGGACA ATTTGGTAAA TTGTTTCATGG	5640
TTTCTCCTTA TCATCATTTA CTATTCTTTG AAAATCAAAA TTTCTCGAAC AGCAACTATT	5700
ATACCCTAAA ATCAGCATTT TGACAAATTT AGAAAAAAC CGATATCAAT CTATCGGCTT	5760
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TTCAAACCAG TTGTATCAAG GTAGACAGCA TCCTCTGCTT GTTTGAGAGG AGAAGTCTCA	5880
CGATGACTAT CCTTGTAGTC ACGCGCAGCA ATTTCTTTT TTAGGGTTTC AAGGTCTGTT	5940
TCAATTCCCT TGGCAATATT TTCTTGTAAG CGACGCTCTG CTCTCTCATC AACAGAAGCT	6000
ACTAGGAAAA TTTTCAATTC TGCTTGTGGC AATACAACAG TTCCAATATC GCGACCATCC	6060
ATGACAATCC CGCCTTGCTG GGCATTTTCT TGTGGGAGAG AAACCAGTTT CTCACGCACT	6120
TGAGGAATTG CTGCAATAGC AGAAACATGA TTGGTCACTT CATTTTCACG GATAGGATGG	6180
GTAAATATCCA CATCTCCTAC AAAACAAGC TGGTCTCCAG TTTCTGAACG TCCAAAGCTG	6240

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ATTGGATGCT GGTCCAACAA GGCTAGAAGG GCTTCGACTT CTTCAACTCC TAATTGGTTC	6300
TTAAGAGCCA TATAGGTCGC TGCACGATAC ATAGCTCCTG TATCAAGGTA GGTGAATCCA	6360
AAATCCTTAG CAATAATCTT TCGGACCGTA CTCTTACCGC TGAAGCAGG ACCATCAATA	6420
GCAATTGAA TTGTTTTCAT ATCGGCTCCT ATTTTATTTT TATAACATCA CCTGGATTAG	6480
CAAACCAAGA TCCTGTAGCC ATGTGCCAG GATTCAAGGC CTCTAACTGA GCAATGGAGA	6540
TTCTGCACG AGCGGCAATA GCTGCTTCCC CTTCTCCTGC GAGAACTTTA ATCGTTCCTT	6600
CAGGATTAGC AGCTTCTTCT GAACTACTAG AAGTAGATTC TGGCTCTGAA CTCTGCTCAG	6660
GCTGAGAACT ACTTGAAGAT GAGATTGTGA CTACACTGGC ATCAGAATCA TGAAAGCCTT	6720
TTAAGGCTGC TGTGCGATTA CTCCCCCCG ATGATAGATA GATGAGAACG ATGACCATCA	6780
CCACCACAAT TACAAAGAAA ATACTAGCTA GGATCGTCAA AATACGATTA GCCATCCTAT	6840
CAGCCCCCTCC GTGGTTTCGA TGCCGACGCT CTGCTCTTGA TTCTTCTTGA TCATAGATAT	6900
CTTCTTGCCA CGGTTCTTTT GCCATACCTT ACTCCTTGTT TTTTTTACT TTTCTTATTA	6960
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TGACCCTGAC CAACTGGAAA AAGAAATTTT TCCTAGTCAG GATATCTTAG AGGCTGTTAA	7140
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ACTCCCTCTA GTTTAGCACA TTTCCATGTA AAATTATAGT CTTTTCACTT TATTTTTTTC	7260
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TAAATAAATC TTAATGATAT ACTTGCCGAG AATCCCAATG GTCAAGAGTT GAATGCCTCC	7380
AAGAAAGAGA ATAACAGCCA TCAGAGAGGT CCAACCAGAT GTCGGATTGC CCAAAATGAG	7440
GGTCCGAACC ACAACAAAAA AGGTCATCAG CAGAGAAAGA AAACAAGATA GGAGACCAGC	7500
TACAAAGGCT ATAATCAAGG GAAATCTGA AAAATTAATA ATCCCTTCAA TGGAGTAGAA	7560
AAAGAGTTC CTAAACTCC AACTTGTCTT GCCAGCCTGC CTTTCGACAT TTGGATAGTC	7620
CAAATAGTAG GTTTTGAAAC CCACCCAGGC GAAGAGCCCC TTGAAAAAC GATTGGACTC	7680
GGTCAAGCTT AAAATGGCAT CGACTACAGA CCTTCTCATC ATACGAAAAT CACGGACACC	7740
CGACGCAGA GCTACTGGGC TGATTTTTTG CATGAGCGA TAAAAGAGAA CAGCACAGAA	7800
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TACATTTTTG TCTAATACAT TTTTCATCTC AAACAACATA CTAGGAGGAT CTTGGAGGTC	7920
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TTCTTTGCCA AAATTCGAG AGAAAGAAAT ATAATGGACT GCCGGATTTT GCTCCCGATA	8040



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GGCCTTTAAG AGTTCCAAGG TCCCATCACT TGATCCATCA TCGACAAAGA CATACTCGAT	8100
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CTCTTCGTTT AAACAAGGGA CGATGATTGA AATCATCATC TTAGTCTTCA AATCCATTTG	8220
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CCCAACCGAG TTCTGCTTTA GCTTTTGCCG GGTCTGAGTA GCAGGCAGCG ATATCACCTG	8340
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TGATAAAATT TCAGTAAAT GCTTATACTC TTCGAAAATC CAATTCAAAC TACGTCAACG	9360
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CGGCTAGTTT CTTAGTTTGT TCTTTGATTT TTATTGAGTA TTATTGCTT TTTACTCGTT	9540
TGACATAGTT TTCAATTGGG TAATTTAGAG GGTCCAAGGT CAACTCCTTG TCTTGGATCA	9600
GTTGGGCTAG ATGGTAACCA ATGATAGGAC CAGTTGTGAG GCCTGATGAA CCTAGTCCAC	9660
TGGCTGCATA GACACCAGTT AAGTCAGGCA CCTGCCCCAA GAAAGGAGAG AAATCACTGG	9720
TGTAGGCACG GATTCCAACA CGCTCAGATT TTGAAGTAGC TTCAGCCAAA ATCAGATAGT	9780

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GAGTCAAGGT GGCCTCCTCC ATTTGTTGGA GCAAGGTTTC ATCTACCGTC AAATCAAATC	9840
CCATGTCATT TTCGTGGGTA GCGCCTAAGG ATAATTTCCC ACCTGCAAAG GGAATCAAAT	9900
CCCACCTCCCC TTCTGGCATG ACAACAGGGT AATCTTCCAT GTCTTGGGCA AGCTGATAAT	9960
CTCGTAGTTG TCCTTTTGA GGACGGACAT CCACTTCATA ACCTAAAGGC TCTAACATGT	10020
CCCCCAACCA AGCTCCCGTC GCCAAATAA CCTGCTCAA CTCTCTTCA CCAATCTGGT	10080
AGCCTGATGC TAACGGTGTC AGAGTCACTT TTTCTTTGAC CAGCTTGACA TGA CTGACTT	10140
CCAGCAAACG AGTCACTAAA AGTTGGCCAT CTACTCTCGC TCCACCAGAA GCATAGAGCA	10200
GGCGGTCAAA TCCCTGCAA CCAGGGAATA ATTCATTAGC TGAGGCTTGG TTCAGAAATGG	10260
CTAATTGCCC TATCAAGGGA GATTCTTCTC TCGCTGGAG GGCCAGTTGA TAAAGTTCTT	10320
CCAAATGGA TTCATCCTTT TTCAAGAGAA AGACTCCGA ACGCTGGTAA AAGTCGATTT	10380
CTTGTCCTGA TTTCTCTAAA TCAGCTAATA AATCCACATA AAAATCAGCC CCCAAGCGCG	10440
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CGGCCTTGGT GGCTTGACCT TGCTCATGGT CAAAAACGGT CACCTCTAGG TCACTTTCTC	10560
TCGAGAGGTA GTAGGCAGCT GTTGCTCCCA CAATTCCTGC TCCAATAATG GCAACTTTTT	10620
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AAGATATCAA TAGACCACCC CTTATCTTCC TTCCATTGAC TAAGAAGTGC TGCATTTTTT	10740
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AAAGCATCCT TATAGAAAGA CTGCCCCTT CCACCACAAA TTGCTACTCT TGAAATAGGC	10920
TTCTGCAAAT CATCTCTTG ATAATGCACC ATTCGAAGGC TATCTAGGTC AAAGACTTGC	10980
TTGACCTGTT GGGCCAATTC CCAAATGTC TGAGGCTGAA TATTCCTCAAT ACGTCCAATT	11040
CCACGTTCTG GACCTGTTTC CTGCAGATAA GTCGTCTCCT CGATTCTAG CATCTGACAA	11100
AACCAGTCAT TGAGCCCAT TTCAACGATA TCAATATTGG TATGGCTGAC ATAAACTGCG	11160
ATATCATGCT TAATCAGGTC GATGTAAATC TGATTTTGGC GACGGCTGGC AAGCAAGTCC	11220
TTGATAGGAC GAAAGATAGG CGCGTGCTTG ACGATAATCA AGTCCACACC CTTTCAATG	11280
GCCTCTGCCA CTGTCTCTTC ACGAATATCG AGGGCAACCA TGACCCTTTG GATACCCTTG	11340
TCTAAAGTGC CAATTTGCAG ACCACGGCTG TCTCCCTCCA TAGAAAATTC CTGAGGGCAA	11400
AAGGCTTCAT AAGCTTGAT CACTTCACCT GCTAACATGG AGCACCTCCT TGATAGCTTG	11460
AATCTTATCT ACTAGAACTT GACGTTCTTC CAGATTTTTT TCTGGGATTT GTCCGAGGGC	11520
GAACTCTAGC TTCTCAGCTT CTTTTTGCCA TTTTGGACA AATACTGGAC TGACTTCTTT	11580

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GGACAAGAAG GGACCAAAGC GAACATCACT GGCTGATAGC TTCATTGTGC CTGCTTCCAC	11640
CACCAAAATC TCATAAACT TTCCAGCTTC TTCTAAGATG CTTTCTGCTA CAATCTGGAA	11700
TCCATGATCC TGAGCCAGA TACGCAAGTC GTCTTCACGA TTATTGGGCT GGAGGATCAA	11760
ACGCTCTACA TTAGCTAACT TCCCCAAACC TTCTTCTAAA ATCCTAGCAA TCAAACGACC	11820
ACCCATGCCA GCAATGGTAA TGACAGACAC TTGGTCAGTC TCTTCAAAAG CTGCCAAGCC	11880
ATTGGCTAAA CGGACTTGA TTTTCTCCTT TAGGCCGTGA GCCTCAACAT TTTAACC GC	11940
AGACTGATAG GGACCTTCCA CCACCTCACC TGCAATAGCG CTTTGTATTG GGCTCTCTC	12000
AACCAACTCG ATAGGCAGAT AAGCATGGTC ACTTCCCACA TCTAGTAAAA TAGCCCCCTG	12060
TGACACAAAG GAAGTACCA ATTCTAATCT CTTTGAATC ATCTTCTCTC ACTTTCCAAA	12120
ACTCTATTAC CTCTTATTAT ACCACATTTT AATCTTCAAC TTCCCAGTAA TATAAGCACC	12180
TCTGGCGAAA GAAGTTTCAA TGTCTAAAG TAATAAGTGA ATCCAATTGA AAGATTTTAA	12240
ACAATTGCA AAAATGTCAA AAAATAAAAA ATAAACAGTT TATTCAGAAA ATTCTTGACA	12300
TATAAAAACA CATGGTAGAA TATAATTAGA AAGTTAGAAA AAATAAAAGT TTGACTAAAA	12360
TTTGATTATTG AAGGTGGTGT TCAGATAAGA AATTTAGTCA GACGAACCAC GAATTTGCTC	12420
TATGCTTTCT GGAATTTATC ATAACAGGAG GATACAGTCA TGGAACAAAC ATTGTTTGAA	12480
TTAGAACTAC TTCCAGAGGA AGATATCATT GTCACAGGTC TCCCTAAGTA TTGTTCTTTT	12540
ACTTGTTTAA TTACAGGTCG CTAGTTATAT TTTATATAAA ATAAGTAGCT TTACTTACGG	12600
AATAGGCTAG TGCTGTGTCT CTAGCCTATT TTAATAATTA GGAGTTTGTT ATGGATTTAT	12660
TAGAGAAAGA ATGTTTAAAA TGTGATAAAA ATTTCCAACA GGGTGATATT TGGAACTACT	12720
ATTATTTATC AGATAAGATG CCTGCACAAG GGTGGAAAAT ACACATAAGC TCCCAAATAA	12780
AAGACGCTGT AAATATTTTT AAGATTGTGT ATAACTATC CCAACTAAAT AATTGTAGCT	12840
TTAAAGTTGT TAAAAATTTA GAGGAATTAA AAAAAATTAA TTCCCCTAGG GAAATGAGCC	12900
CTACTGCTAA CAAATTTATA ACTCTATATC CTAAGTCAGA ATCTGAAGCT AAGAGTATGA	12960
TTTGTAATCT TACGAATAGA CTGTCAGART TTAAGGCTCC AAAAATACTA TCTGACTATC	13020
AATGTGGAAT GCATCTCCA GTTCATTATA GATATGGGGC TTTTAAAAA AAACAAGCTT	13080
ATGATGAAAA AAATAAAAAA GTCATCTATT TATTGCTAGA TGAAAAAAGG AAGAACTATG	13140
TAGAAGATAA GAGACAAAAT TTCCCTAGTC TTCTAGCTG GAAAATGGAT TTATTTTCAG	13200
AAGAAG	13206

(2) INFORMATION FOR SEQ ID NO: 34:

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## (i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 13104 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: double
- (D) TOPOLOGY: linear

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO: 34:

CCGGATCCAG CGAAAAATAT GCTCTTGAT GCTGTAAGTG GTCAAAAAGA TGCTAAAACA	60
GCTGCTAACG ATGCTGTAAC ATTGATCAAA GAAACAATCA AACAAAAATT TGGTGAATAA	120
AAAATTGTGT CAAGGGGGGT GGAAATCAAA TCCCCCTTTG AATTTATCAA TAGAGACACA	180
AATAATTTAG CTTTCTTATA AAAAGTAGT ATCCTATGAA AGGAGTTAAT ATGGAAAAGC	240
AACAACCTAG TAAAGCAGCC CTGCTGTCTA TCATTCCCTGG GTTAGGACAG ATTTACAATA	300
AACAAAAAGC CAAAGGTTTT ATCTTCCTTG GTGTAACCAT CGTATTTGTC CTTTACTTCC	360
TAGCACTTGC AACCCCTGAA TTGAGCAACC TCATCACTCT TGGTGACAAA CCAGGTCGTG	420
ATAATTCCTT CTTTATGCTG ATTCGTGGTG CCTTCCATCT AATCTTTGTA ATCGTTTATG	480
TACTCTTTTA TTTCTCAAAT ATCAAAGATG CACATACGAT TGCAAAACGC ATTAACAATG	540
GAATCCAGT TCCACGCACA CTCAAAGACA TGATCAAAGG GATTTATGAA AATGGCTTCC	600
CTTACCTCTT GATCATTTCA TCTTATGTTG CCATGACCTT CGCGATTATC TTCCCAGTTA	660
TCGTAACCTT GATGATCGCC TTTACCAACT ACGACTTCCA ACACCTGCCA CCAAACAAGT	720
TGTTGGACTG GGTGTTTGG ACCAACTTTA CAAACATTTG GAGCTTGAGT ACCTTCCGTT	780
CTGCCCTTGG TTCTGTTCTT TCTTGGACTA TCATTGGGGC TTTGGCAGCT TCTACTTTAC	840
AAATCGTAAT TGGTATCTTC ACAGCTATCA TTGCCAACCA ACCATTTATC AAAGGAAAAC	900
GTATCTTTGG TGTATTTTTC CTTCTTCCTT GGGCTGTCCC AGCCTTCATC ACTATCTTGA	960
CATTCTCAAA CATGTTTAAC GATAGTGTG GTGCTATCAA CACTCAAGTA TTGCCAATCT	1020
TGGCTAAATT CCTTCCTTTC CTTGATGGAG CTCTTATTCC TTGGAAAACA GACCCAACIT	1080
GGACTAAGAT TGCCTTGATT ATGATGCAAG GTTGGCTCGG ATTCCCATAC ATCTACGTTT	1140
TGACCTTGGG TATCTTGCAA TCTATTCCTA ACGACCTTTA CGAAGCAGCT TATATTGACG	1200
GTGCCAACGC TTGGCAAAAA TTCCGCAACA TCACCTTCCC AATGATTTTG GCTGTTGCGG	1260
CACCTACTTT GATTAGCCAA TACACCTTCA ACTTTAACAA CTTCTCTATC ATGTACCTCT	1320
TCAATGGTGG AGGACCTGGT AGTGTGCGAG GTGGAGCTGG TTCAACCGAT ATCTTGATCT	1380
CATGGATCTA CCGTTTGACA ACAGGTACAT CTCCTCAATA CTCATGGCG GCAGCTGTTA	1440
CCTTGATTAT CTCTATCATT GTCATCTCAA TCTCTATGAT CGCATTCGAG AACTACACG	1500

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CATTTGATAT GGAGGACGTC TAAGATGAAT AACTCAATTA AACTCAAACG TAGACTGACT	1560
CAAAGCCTTA CTTACCTTTA CCTGATTGGT CTATCAATTG TAATTATCTA TCCACTGTTG	1620
ATTACCATTA TGTCAGCCTT TAAAGCAGGT AACGTCTCAG CCTTTAAACT AGATACTAAT	1680
ATCGACCTCA ATTTTGATAA CTTTAAAGGC CTCTTCACTG AAACCTTGTA CGGTACTTGG	1740
TACCTCAACA CTTTGATTAT CGCCTTAATT ACCATGGCTG TTCAAACAAG TATCATCGTA	1800
CTTGCTGGTT ATGCTTACAG CCGTTACAAC TTCTTGGCTC GTAAACAAAG TTTGGTCTTC	1860
TTCTTGATCA TCCAAATGGT GCCAACTATG GCCGCTTGA CAGCCTTCTT CGTTATGGCG	1920
CTTATGTTGA ACGCCCTTAA CCACAACCTGG TTCCTCATCT TCCTCTACGT TGGTGGTGGT	1980
ATCCCGATGA ATGCTTGGCT CATGAAAGGC TACTTCGATA CAGTGCCAAT GTCTTTAGAC	2040
GAATCTGCAA AACTAGACGG TGCAGGACAC TTCCGCCGCT TCTGGCAAAT TGTTCACCA	2100
CTTGTCGCC CAATGGTTGC CGTACAAGCT CTCTGGGCCT TCATGGGACC TTTCGGGGAC	2160
TACATCCTCT CTAGTTTCTT GCTTCGTGAG AAAGAATACT TTAAGTGTGC CGTAGGTCTC	2220
CAAACCTTCG TTAACAATGC GAAAACTTG AAGATTGCCT ACTTCTCAGC AGGTGCTATC	2280
CTCATCGCCC TTCCAATCTG TATTCCTTTC TTCTTCCTAC AAAAGAACTT TGTTCAGGA	2340
CTTACAAGTG GTGGCGACAA GGGATAATTT ATCCCGCCA CCCTTTTCA TTTTATACTC	2400
TTCGAAATC TCTTCAAACC ACGTCAGCTT TATCTCCAAC CTCAAAGTTG TGCTTTGAGC	2460
AACCTGTGGC TAGTTTGCAC TTTGATTTTC ATTGATTATT AGCAATTGTC ACTGTAAATA	2520
ATATCCTTGT AGCAAGCAAT TTTTCTCCTA GACTTGAAAT AAAGCGCAT TCTCTATATA	2580
ATAATACTCA TATAGAAAAC ACCTTTTAGA AAGATACCTA TGCTTCCATA TCCATTTTCC	2640
TATTTTCAA GTATTGGGG GGTTGTAAG CCCCTGTCCA AACGTTTGA GCTCAACTGG	2700
TTTCAACTTC TCTTACCAG TATCTTCTT ATCAGCTTGT CTATGGTACC CATTGCTATC	2760
CAAAACAGCT CCCAGGAGAC CTATCCGCTA GAACTTTTA TCGATAATGT CTATGAACCT	2820
CTGACAGATA AGGTTGTCCA GGATCTCTCT GAACATGCTA CAATTGTCGA TGGCACATTA	2880
ACTTATACTG GAACAGCTAG TCAAGCCCCT TCTGTTGTGA TTGGTCCAAG TCAAATCAAG	2940
GAATTACCTA AGGACTTGCA ACTGCATTTT GATACAAATG AGCTAGTCAT CAGCAAGGAA	3000
AGCAAGGAAC TGACCCGCAT CTCTTACCGA GCCATTCAGA CTGAGAGTTT CAAAAGCAAA	3060
GACAGCTTGA CCCAAGCAAT TTCTAAAGAC TGGTACCAAC AAAATCGTGT CTATATCAGC	3120
CTCTTCCTAG TTCTCGGTGC GAGCTTCCTC TTTGGTTTGA ATTTCTTTAT CGTCTCTCTT	3180
GGAGCTAGCT TTCTCCTTTA TATCACCAAA AGATCACGCC TCTTTTCATT TAATACCTTT	3240

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AAAGAGTGCT	ACCATTTTAT	CTTGAAGTGT	TTAGGATTGC	CGACTCTGAT	TACACTTATT	3300
TTGGGATTAT	TTGGCCAAAA	TATGACAACC	CTGATTACTG	TACAAAATAT	TCTTTTGT	3360
CTGTATCTGG	TCATATCTT	TTATAAAACA	CATTTCCTGT	ATCCAAATTA	CCATAAATAG	3420
GAGATTTT	TGCCCGTTAC	GATTAAAGAC	GTGGCCAAGG	CTGCTGGTGT	TTCCGCTTCA	3480
ACCGTAACCC	GTGTATTCA	AAATAAATCA	ACCATTAGCG	ACGAAACAAA	AAAACGTGTT	3540
CGCAAAGCTA	TGAAGGAACT	CAACTACCAC	CCAAACCTCA	ACGCTCGTAG	CTTGGTAAGC	3600
AGCTATACTC	AGGTTATCGG	ATTAGTTCTT	CCTGATGACT	CAGACGCCTT	CTACCAGAAT	3660
CCTTCTTTC	CATCGGTTCT	ACGTGGCATC	TCTCAAGTCG	CATCTGAAAA	CCACTATGCC	3720
ATTGAGATAG	CAACAGGGAA	AGATGAGAAG	GAGCGTCTCA	ACGCTATTTC	ACAAATGGTC	3780
TACGGCAAGC	GTGTAGATGG	GCTAATTTT	CTCTATGCCC	AAGAAGAAGA	CCCTCTCGTA	3840
AAACTCGTCG	CAGAAGAACA	GTTCCCTTTC	CTTATCTTAG	GTAAATCTCT	ATCTCCTTTC	3900
ATCCCACTTG	TCGACAACGA	CAATGTTCAA	GCTGGTTTTC	ATGCGACTGA	ATATTTCATC	3960
AAAAAAGGCT	GCAAACGCAT	TGCCTTTATC	GGAGGAAGTA	AAAAGCTCTT	CGTGACCAAA	4020
GACCGTTTAA	CAGGCTATGA	ACAGGCGCTT	AAACATTACA	AACTTACCAC	TGACAACAAT	4080
CGCATCTACT	TTGCCGACGA	GTTTCTGGAA	GAAAAGGGCT	ATAAATTTAG	CAAGCGATTA	4140
TTCAAGCAGC	ATCCACAAT	TGATGCTATC	ATCACAACCG	ATAGCCTCCT	AGCTGAAGGT	4200
GTTTGTAAGT	ATATTGCCAA	ACACCAGCTG	GATGTCCCTG	TTCTCAGCTT	TGACTCGGTT	4260
AATCCCAAGC	TCAACTTGGC	AGCCTATGTC	GATATCAATA	GTTTAGAGCT	TGGTCGTGTT	4320
TCCCTTGAAA	CTATTCTCCA	GATTATTAAT	GATAATAAAA	ACAATAAACA	AATTGTGTTAC	4380
CGTCAATTGA	TCGCCACAAA	AATTATCGAA	AAATAAGAGA	CTGGGCAAAA	AGTCGTTAAA	4440
AGCAAAAACG	CATACTATCA	GGTATTGAAA	AAACTTGATA	CTATGCGTTT	TATTGTGGGA	4500
AGATTTACTT	CCTTTTCTAC	TGAAATTGAG	TCTTTTCCCA	AGATCTTTTT	ATACTCAATG	4560
AAAATCAAAG	TGCAAACCTAG	GAAGCTAGCC	GCAGGTTGCT	CAAAACACTG	TTTGAGGTT	4620
GTAGATGAAA	CTGACGAAGT	CAGTAACCAT	ACCTACGGCA	AGGTGAAGCT	GACGTGGTTT	4680
GAAGAGATTT	TCGAAGAGTA	TTAATCACTA	ATTATCTATC	TCAACAAATC	TTCTAGAAT	4740
ATGAACATTT	TCCGAGACAG	AGACAAAGGA	GCTTGGATCC	ACTTGTGTCA	TAATCTGTTT	4800
AAATTCATTA	AACTCTGCAC	GTGTAATGAC	AGTGATTAAA	ACTGCCTTTC	TCTCGTGATT	4860
ATAGGTTCTT	TCTGCATCGT	GGATCATGGT	TGCTCCGCGG	TGCAATTTTT	TATGGATTTT	4920
TTCAATTACC	TTCTCTGGAT	GATTGTGCAC	AATCATGGCC	TGCATACGCT	TTTGCTTAGT	4980
AAAGACTGCG	TCTGTACAC	GGCTAGAGAC	AAAGATGGTA	ATCATAGAAT	AAAGAGCGTA	5040

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TTTCCAACCA AAGGTCAAAC CTGCTATCAG CATGATAGTT CCATTTACCA AGAAAGAAAT	5100
ACTACCGACA TTCTTACCCG TTTTCTTACG AATAGTCAGG CTGACGATAT CCGTCCCACC	5160
ACTGGAGATA TTGTTTCGAA GAGCAAAACC AATCCCCAAA CCCATAACAA CACCCCCAAA	5220
AAGGGAATTG ATAATGGGAT CCTCTGTCAA GGTGCCCACA GGGACAAACT GGATAAAGAA	5280
GGAACTCATA GATACCGTGA TAAAGGTAAA GACGGTGAAC TTATGGCCAA TCTGATACCA	5340
AGCTAAGACC ATCAAAGGGA AGTTAATGGC GTAGAAGCTT AGCGAAATCG GAATATGAAA	5400
ACCAAACCAG TGATTACTCA AGGCAGAGAT AATCTGTGCC AGACCTGTTG CACCACTCGA	5460
ATACACATGC CCTGGTTGGA AAAAGAAATT AACTGCTACT GCTGATAAAA AACCATAGAC	5520
CAGAGAGGCC GAAATCTTCT CATCATACTT TTCTCGAGAG ATACTTTGTA AGACACGTAA	5580
AATTTTATC TGATAAGCAA AGCGGCGCAG ATAATAGCGC CACCGCTTAA TTCGTTTGT	5640
TTGTTTCATC TTCTTCTACT TGTAAGCTGA GTTCCTCTAG TTGTTTGAGA GCGACTGTTG	5700
ATGGAGCTTG TGTCATTGGG TCAGTTGCCT TGTGTCTCTT AGGAAAGGCA ATGACTTCAC	5760
GGATATTTTC TTCTCCAGCA AGCAACATGA CAAAACGGTC AAGCCCCGATA GCCAAACCAC	5820
CGTGTGGTGG GAAACCATAG TCCATGGCTT CAAGAAGGAA ACCAAACTGG TCATTGGCTT	5880
CTTCAGTTGA GAAACCAAGA GCCTTGAACA TGCGTTCTTG AAGGTCTTTT TGGTTGATAC	5940
GAAGGCTACC ACCACCAAGC TCATAACCGT TCAAGACGAT ATCGTAAGCA ATGGCACGAA	6000
CCTTAGCCAA ATCACCTTCT AATTCATGAG CAGTCTCTTC CTGTGGAAGT GTGAAAGGAT	6060
GGTGGGCGCT CATGTAGCGG CCTTCTTCTT CAGACCATTG AAACATCGGC CAGTCAACCA	6120
CCCAAAGGAA GTTGAACCTA TCATTATCAA TCAAGCCAAG CTCTTTAGCA ATACGTCCAC	6180
GAAGGGCACC CAGTGTGCA TTAGCCACTT CAAGCGTATC CGCCACAAAG AGAACCAAGT	6240
CCTTATCTTC AAGAACAAGC GCTGTGTGCA ATTCTTCTTG GATACCAGTC AAGAACTTGG	6300
CAACTGGTCC GTTTAATCTT CCATCAACCA CCTGACCCA AGCAAGACCT TTGGCACCAT	6360
ACTGTTTGGC TACTTCCGTC ATCTTGTGCA TGTCTTTACG TGAATAGTTG TCCGCAGCTC	6420
CTGTGACCAC AATCGCTTTT ACAGCAGGTG CTTCTGAAAA GACTTTAAAG TCTACACCTC	6480
GGACCACTTC TGTCAGTCC TGAAGCAACA TGTCAAAACG AGTATCTGGC TTGTCAGAAC	6540
CGTAAAGAGC CATAGCATCA TCGTATTTC TACGAGGGAA TGGTAGCGTT ACTTCGATGC	6600
CTTTTGTTC CTTCATCAG CGCGCGATCA AGCTTTCTGT AATATCTTGG ATTTCTTGCT	6660
CAGTAAGGAA GGACGTTTCC AAGTCGACCT GAGTAAATTC AGGCTGGCGG TCTCCACGCA	6720
AGTCCTCGTC ACGGAAACAT TTAACGATTT GGTAGTAACG GTCAAAACCA GCATTTCATCA	6780

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AGAGCTGTTT	CGTGATTGTG	GGACTTTGAG	GAAGAGCGTA	AAAATGCCCC	TTATTAACAC	6840
GAGACGGCAC	TAAATAATCA	CGCGCCCCCT	CAGGCGTTGA	CTTAGAAAGG	AATGGTGTCT	6900
CCACGTCGAT	AAACTCCAAC	TCATCCAAGT	AGTTGCGGAT	AGAGTGGGTC	ACCTTGGCAC	6960
GAAGTTTAAG	ATTTTCCAAC	ATTTCTGGAC	GACGAAGGTC	AAGGTAACGG	TAACGCAAAAC	7020
GTGTATCGTC	ATTTGCCTCA	ATGCCATCCT	TAATCTCAAA	TGGTGTGTGC	TTAGCTGTGT	7080
TAAGCACAAT	AAGAGCTGTC	ACGTTTAACT	CAACCGCACC	AGTTGGCAAC	TTATCATTTGG	7140
CTTGTCACGC	GCAGCGACCT	GACCAGTCAC	CTCAATAACA	AATTCGCTAC	GAAGGcTTTC	7200
AGCTGTTGCC	ATAACCTCTG	CAGATACTTT	TTCAGGGTTG	ATAACCAACT	GCATGATTCC	7260
TTCACGGTCA	CGAAGATCGA	TAAAGATCAA	ACCACCAAGG	TCACGACGAC	GGCCAACCCA	7320
TCCTTTCAAG	GTTATTTCTT	GTCCGATGTG	TTCCTCACGA	ACACGACCAG	CATACATACT	7380
ACGTTTCATT	ATTTCTCTCC	TCTTTTATTTC	TGTTACTATT	TTACCATAAA	AGCGCAGCTC	7440
TTCATGAAAA	TCATCAGAAA	AGTTTGCCAG	TCTTTAAAAG	TCAGGTGAAA	GCCCTAAAAA	7500
TTAGCGCTAA	TACTCTTCGA	AAATCTCTTC	AAACCACGTC	AGCGTCGCCT	TACCGTATGT	7560
ATGGTTACTG	ACTTCGTCAG	TTTCATCTAC	AACCTCAAAA	CCATGTTTGT	AGCTGACTTC	7620
GTCAGTTCTA	TCCACAACCT	CAAAACAGTG	TTTTGAGCAA	CCTGCGGCTA	GCTTCCTAGT	7680
TTGCTCTTTG	ATTTTCATTG	AGTATAATAC	AAAAATCCGA	TGAACCTCAC	CGGACTCTTT	7740
TATTTTGAAT	TTTTCGCTGC	TTTACGCTTT	TCAGCGATTT	CGGCTGCCTT	TCGAGGCAAG	7800
ACAATTTCCG	TTATGTAAGC	CGTCCCAAAA	CGCAGTACAC	CTGCAATAGG	AGCAAAGACA	7860
ACTGCTAGAT	AGTTATAGAA	GAAATCGCCT	TTGAAGGCAT	AAGCTAGCGC	TCCAATGATG	7920
AAAAATAGAA	CGACTGCCTG	AATCACTGCT	AATAAAATTA	CTCGTTTCAT	GTGACCTCCT	7980
GACTCTATTA	TAGCATGAGA	ATCATCAAAA	AGCCGACTAA	ATTATTCAAA	GCGTGAAGAG	8040
AAATACTGTA	GACCAGACCT	TTTCTGCTAA	TGTAAGCCAA	ACCCAAACTA	AAACCAAGGC	8100
TAAATAGAC	AAAAAATGTG	TGCACATCAC	CTGGAAAATG	AATCAAGGCA	AATAGAAGAC	8160
TAGATACCAG	AAGAAAAATC	AGGGTTCGTT	TACTATTGTC	CTGCTTAGGA	AAGAGATAGC	3220
GTGCTAACAT	CCCTCTAAAA	ACAATCTCTT	CCGTCAAAGG	AGCAAAAATA	ACCACAGCAA	8280
AGAATGAGAA	AAGTGGTTGA	GACAAGGTCA	AGTCTGTCGC	TATTTGCTGA	TTTACTGAAG	8340
GATCATCTGG	CAAGAAGAAT	TGAACGACCA	GAGATAAGAA	CCAAACCAAG	ACAGGAAGCC	8400
AAATAAATCG	ATTAAAGCCG	CTCTTCTCAA	TATGAACAGG	AGCCTTCTGA	TACCATTGTG	8460
AAATGCCGTA	CACATATACT	CCAGCCAAGG	CCACATAGAG	TAGAGTAACA	GCATAGGGTG	8520
AAGCGCCTAA	AGCAAGCGAC	GCAGTCGCGA	GCCCTGAAT	AAAGCCATAG	ATAAATAAAA	8580



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AGGATAGAAG GGCTAGAAGA ATCCAGCCAA GGTTTTTAAG TAATTCATA GATAACTCCT	8640
TTATTTGAAA TAACGTTTTA CCATAGGTAA CTGCATCACA TTGATATAAA CATGGATGGC	8700
TCCTACAAGC AAGAAAGCTA GTAACGAAT CTCTCCTGTC AAGAAAGAAA TGATAATAAG	8760
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TTCCAAATTA GCCTGACGCT CCCCTTCATC ATAAGAATTT ATATAGTTCA AGACATCCTT	8880
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TGTATGCAAT ATAATCACCT CACTTAATGA AATAAAAATA GCCAATGGAA TCGCTACACC	9060
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TTCAATCAGA TCGTCATCCA TTTCCTCTTG ATACAAAGAA TGAAATTTTC TGCTTTTCTT	9180
TAAGAAATTG AAAGTCAAAA ACATACTAAT GAAACCTATC AGTAAACAAA TAGCTGATAT	9240
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CATCCCTACA AACATGCCCA AGAACCCCC AAGACAATAG ACATCAAAAA TAACAATCTA	9360
CGTTTCTTTT TCATATTCAT TCTCCTTTT CACTTGCTAG ATTTTGGAT TTCTTTTCAA	9420
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GATTAAACCA GCTTAGGTCC ATCCCAATCA GTAGAAATAC GCTGACTAAT AAAGCTATGA	9540
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GTTACACACC TACTCTCCGT CAAATTCAAC GGTTCGGATA TCCTCAATAC GTTGCAACTT	9840
GAATTTTCT TTTCCCGTAT TATCTACAG TCGTAGCTTT ACCCATTCCT CATCAACATC	9900
CACAACTTCC CAGTTATCTG GCCCAATATA CACTCCCGTT ATAATTGGTT CCTTTCCAAT	9960
CATTTCTTGT AATAATCTCG ACATTTCTGC GTTTCCTTTC TCTTTTCGCT CAAGCTTTT	10020
GATTTTATTC TCTAGTTTCT TGATTTTTTT AGAATTATTA GAATAAAGA AAATCATAAA	10080
TAGTATAAAT CCTAGTACCC ACATTATAAC TCCTTTCTGC TTCCTATTTC TTAAC TTGAA	10140
TTCAATGTAA CATATCTTTT TCTTTTGTAC AAGTATAGTT GTCAAAAAA TTATGATTTT	10200
TGTCATTTTG CAAAAGAAAA AGGTCAGGAG TAGGTTCTTG ACCACTTTAT CTATCATTA	10260
TACTCTTCTA AAATCTCTTC AAACCACGTC AGCTTCACCT TGCCGTAGGT ATGGTTACTG	10320

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ACTTCGTCAG TTTCATCTAC AACCTCAAAA CCATGTTTTG AGCTGACTTC GTCAGTTCTA	10380
TCCACAACCT CAAAACCATG TTTTGAGCTG ACTTCGTCAG TTCTATCCAC AACCTCAAAA	10440
CCATGTTTTG AGCTGACTTC GTCAGTTCTA TCCACAACCT CAAAACAGTG TTTTGAGCAA	10500
CCTGCGGCTA GCTTCCTAGT TTGCTCTTTG ATTTTATTG AGTATAAAAT CCTAGTTTTT	10560
CAAAGATTTC TGAGAAGTTT TGGCTGATTG TCTCAAGTGA CACTTGCACT TCTTCTCGGG	10620
TTTGGTTGTT CTGACCGTC ACTTGCCGC TTTCGACTTC GCTCTCTCCT AGGGTGATGA	10680
GGGTCTTAGC CGCAAAGACA TCGGCTGACT TGAAGTGAAG TTTTAGTTTA CGGTTGAGGT	10740
AATCACGCTC TGCTTTGAAA CCTTGTGGC GAAGAGCCTG TACCAATTCC AAGGCCTTGA	10800
TATTTGCCCC TTGCCCCAAG ACTGCGATAT AGACATCTAG GCGTTTTCG ATAGGGAGGG	10860
TCACACCTTG CTTTCAAGG ATGAGAAGCA GCGCTCTAC ACCAAGTCCA AAACCAATC	10920
CAGCAGTTTC AGGCCTCCA AAGTAAGCAA CCAAACCATC GTAGCGACCA CCGCACAGA	10980
CGGTCAGGTC ATTGCCCTCA ATCTCTGTGA TAAACTCGAA AATGGTGTGG TTGTAGTAGT	11040
CCAGACCACG CACCATATTG GTATCGATGA TGTAACTAC TCCAAGATT TCCAACATCT	11100
GACGCACAGC ATCAAAATGA GCTTGGCTTT CTTCATCAAG AAAGTCCAAG ATAGACGGCG	11160
CATTCTCTAC TGCCACCTTG TCTTCTTTTT CCTTAGAGTC CAAGACACGA AGAGGATTTT	11220
CCTCCAAGCG ACGTTGGCTA TCCTTAGACA AGGTCTCCTT GAGCGGTGTC AAATAGTCAA	11280
TCAAGGCTTG GCGGTAGGCT GCACGGCTCT CAGGATTCC AAGAGTGTG AGGTGCAATT	11340
TGACACCTTG AATACCGATT TCCTTCAAAA AATGGGCTGC CATAGCGATT GTTCCACAT	11400
CGGTAGCTGG ATTGCTAGAG CAAAACACT CAACACCAAT CTGGTGGAAT TGGCGCAAGC	11460
GCCCTGCCTG TGGACGCTCA TAACGGAACA TAGGTCCCAT GTAGTAGAAC TTGCTTGGCT	11520
TTTGCACTTC TGGGGCGAAA AGTTTATTTT CCACATAGGA ACGGACAACG GGTGCAGTTC	11580
CTTCTGGACG GAGGGTAATA TGACGGTCAC CCTTGTGATA AAAATCGTAC ATTTCTTGG	11640
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GCGTGCGCAC TTCTGCATAG TTGTAGCGTT TGAAAATCTC ACGGGCAAAG CCCTCAACGT	11760
ACTGCCACTT AGCAGACTCA GCAGGTAAAA TATCCTGCGT TCCTTTTGGT TTTTGTAAAT	11820
TCATAGGGAA TCCTCTTTAA ACTTAATAGT CTTATTTTAC CATAAATAGA GGGATTAAAA	11880
CAGTAAGAAA AAAATTAGGA TTTAGATATC ATTTTGTAGA TTAAGAATTG TCAAAAAAAT	11940
AGTAGCAAG GAAAGACCAA CAAATAGCAT CCAAGTCAAC TGTATATTCC ATACGGCTAC	12000
TAGTGAAAAA CAAGCTGTTC CCACAGGTAT GGATAAGGTA AACAATAGAC CTAAAAAAAT	12060
ACTAGTACGA GCTAGAACCT CTGGAGCTAG ATTTTTCATG AGCATGGCAC TAATCTTGG	12120

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TTGAACCTTA CCAGACACAT ACAGAGTAAA GAAGAGAAAT AGCAAACCAA GCACGACTTG	12180
ATTGAATAAA TTAGCCAAAC CAACTAGACT AAGTCCTACG GTCTCCCACA TCATCAATCT	12240
AGGCAAGGAC TGCTTCCCAA AATAATCATT GCCCGTAAGG CTA CTGATGA TGA CTGATAC	12300
TAAACACAG AATTGATTGA TAAATAGTGC CTCTGTATAA GAAAAATTCA AGAGAGAATG	12360
GCTCAAAAAG AAGATATTAT AAATCCACC CAAAGCGCCA CCCAAGGAAT TAATAAGCAA	12420
GACAGCAAAG AGCATAAAAC CAAAGTTTTT CTGTCCACTT TTAAGAAAA CGAGACGTAA	12480
ATTTCGGTAA ATTGTTAGGA ACTGGTCTTT GATAGAAAGC TTCTCATTTT TTAAGTTTTT	12540
ACCATCAGCA GATGACATG ACAGGCTCAA TTTGCTTTTT CCTAAAAAGA GGATAGTGGC	12600
TGATACTAGG AAAAAGCAGG CATTGATTCC CGCAACGAGA GAAAAATTGT TGACCGATAG	12660
AGCTAAGAGC CAGACTCCGA AAGCTTGACC ACCAATAGCT GAAATATAGG TGATGAACTG	12720
TGAAAAAGAA TAAGCCTCCA TCAGATCATC TTCAGTACT TTTTCCTTAA TAAGAGGCAT	12780
ACGCAGGCCA CTGCAAAAT CACTGATGAT ATCACTAATG ACATTGATCA AACACAGGCT	12840
AGAAAAGGCA AAGAGACTAG CTGCTGAAC AACTAGGGCT GCTAGAAAA ATAGAACCGC	12900
CTGAAACAAA CCGCTATAGA CCATCCATTT GACCTTGTC CTCTGTGAAT CTGCCCGAAT	12960
CCCTGCAAAA ACTGTAAAGA GGGTCGGAAG AATCATGACA ATATTCGCCA TAGCAACAGC	13020
AAAAGATGCT TGTGACAAGG TCGATGCATA GACGATAAAG ACCAGGTTGA AAATCGAAAC	13080
ACCAAAGCA TGAAGAAGC GTGG	13104

## (2) INFORMATION FOR SEQ ID NO: 35:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 19250 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO: 35:

CCGGGCAAAT AGTTTGAAC TTTTCATCAT TTCTCCTTT AAAACTTTCT CTCCATTATA	60
GACTCTTTTC AGAAAGTTGT CAACAGAATT TTCAGAATTT TTGAAAATTA TTTTTCAAAC	120
AACATCTTTG CAAAAATAT GAATATCGTA AGCGGTCAT AACAAGGTAT CTATCATTC	180
TGGAGCTCCT CCTGTATACT ATTAGTAAAG TAAATATTGG AGGATATTTT AATGCCACAA	240
CCTATTGTTT CTGTAGAGAT TCCACAATCT CGTCGTTTGT ATTCTAAAA GAGAAATGAT	300
ATTCTCTTA AAATTCGTAT TGGCAAGCTT GAAGTAAGTT TTTTCAATC TCTCAATCTC	360

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GAAATGATAG AACAGCTTTT GGATAAGGTG TTGCTCTATG ACAATTCATC TATCTAGCCT	420
AGGGCAGGTC TATCTCGTGT GTGGGAAAAC TGATATGAGA CAAGGAATCG ATTCACTGGC	480
TTATCTCGTT AAAACCCACT TTGAATTGGA TCCTTTCTCC GGTCAAATCT TTCTCTTTTG	540
TGTTGGACGT AAAGACCGCT TTAAAGTCCT TTACTGGGAT GGTCAAGGAT TTTGGCTACT	600
ATATAAACGC TTTGAGAAGC GCAGACTGAC TTGGCCCACT ACAGAAAAGG ATGTCAAAGC	660
TCTCGCACCT GAACAAGTAG ATTGGCTGAT GAAAGGCTTT TCTATCACTC CAAAAATATA	720
GTAGATTGAA ACTAGAATAG TACACCTCTG CTTCTAAAAC ATTGTTAGAA ATCGATTTTA	780
CTGTCTGAT CGATTGTGCC TGTATTATT TCAATTTACT ATAAATCCAT CAGAAAGTCG	840
TGATTTCTAT TGAAATGAGG ACTTTCTTTT TATACTCATC TGCTTTCAAA AAGCACTCTA	900
GTCCATCTCC GATTAAAGAT GGACTTTATC ACCTCCTTCT CCAGTCCTTG TATAACATCT	960
TGAAGTTGAT TCATGACATC TTCCAAAGTT CGAAAGGCTT TATTCTTAAA TCCACGTTTA	1020
CGAATCTCTT TCCACACTTG TTCAATGGGG TTCATCTCTG GTGTGTATGG AGGAATAAAT	1080
GCAAAGCCAA TATTAGTCGG AATCTTTAAG GTACTTGATT TATGCCATAT AGCATTGTCC	1140
ATAACGAGTA AAAGATAATC ATCTGGATAA GCTTGTGAAA GCTCCTATTC CTAAAGCCCC	1200
TTTATAACCT CTTGCGAGAG AGACTATTGA CTCAGCCCTT ACTTCATGCG GATGAAACCT	1260
CCTATCGGGT TCTAGAGAGT GATAGCCATC TGACCTACTA TTGGACTTTT TTGTCAGGTA	1320
AAGCAGAGAA ACAAGGGATT ACGCTTTACC ACCATGATCA GTGTCGAAGT GGTTCAGTAG	1380
TACAAGAAAT CCTAGGAGAT TATTCTGGCT ATGTTTCATTG TGATATGTTG CGGCAGTAAC	1440
TTAGGACTTT AGTCCTCTAG TTCTGCCTAT GCGATAGCAG TCCAAGGTTT AGGAGTAAGG	1500
CGACGCTAAG CTTGGTAAAC TGCGAACAGC TAGAAGCTTA TCGTCAACTG GAAGAAGCTG	1560
CACTTGTGG ATGTTGGGCG CATGTGAGAA GGAAGTTTTC TGAAGTGCCC CCCAAGCAAG	1620
CAGATAAATC ATCCTTAGGA GCTAAAGGTT TAGCCTATTG TGATCAGTTA TTTTCCTTGG	1680
AAAGAGACTG GGAGGCTTTG CCAGCTGATG AACGGCTACA GAAACGTCAA GAACATCTCC	1740
AACCCCTACT GGAAGACTTC TTTGCTTGGT GCCGTCGTCA GTCAGTTTTC TCGGGTTCAA	1800
AACTAGGAAG GGCAATTGAA TACAGCCTCA AGTATGAAGA AACCTTTAAG ACCATTTTAA	1860
AAGACGGACA TCTGGTCCTT TCCAATAATC TAGCTGAACG CGCCATTAAA TCATTGGTTA	1920
TGGGACGGAG TAAAGAGTC CAGTGGACTC TTTTAGCCTA AGCTCAGTTT AAAAAACGA	1980
GGGTGGTTAT TTTTAAAAAA GCGAGGGTGG TTATTTTCTC AAAGTTTGA AGGAGCTAAA	2040
GCAAGAGCTA TTATTATGAG TTTGTTGGAA ACAGCTAAAC GTCATCAATT ATAGTCCGTT	2100
GAATCTATAA CAGTACGCAT CGACTGCTAA AATATTTCTA TAAATCAATT TTCTTTCTCT	2160

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AATCGATTG	TTCATATCTT	ATTACAATCC	ATTATAAATA	GCGAGAAATA	TCTATCCTAT	2220
CTTCTAGAA	TGCTTCCAAA	CGAGGAACT	CTCGTAAACA	AAGAGGTTTT	AGAGGCCTAT	2280
TTACCGTGA	CTAAAGTGT	ACAAGAAAAG	TGCAATAAG	AAATCTCCAG	ATTAGGAACT	2340
ATATATGAGT	TCTCTAGTCT	GGAGATTTTT	CAATAGACTT	CGTTATTGGG	CGGTACTTTT	2400
CGAAACTTTG	AAAACCTCAA	AAAACGGATT	TTTATCGCTC	TGAACATCAA	AAAAGAAAGG	2460
ACGAAATTG	TCCTTTCTCA	AGCTTAGCTT	TTCTTCAACC	CACTACAGTT	GACAAAGAGC	2520
CCTTTATTCT	ATCAAACATG	AAGCGCAAAA	ACAAGCCAAA	AATCCGATAG	AATGGCTATC	2580
CCTCGACTAT	CAAGTAAGAC	ATTTCCATCA	AATACGTTCA	ATTTTACTCT	TGTTCTACTA	2640
AGAATTAATC	ATCTCGTTTT	GATTTATTAA	AAATATACAA	TTCAGCTTTT	CCTCCAAACT	2700
ATTTTATCCA	CTATCCCTGT	ATAGCTCTGT	ATTATCTTAA	CAACTTTAGT	AGAGACATTT	2760
TCCTCAACAT	AATCCGGAAC	CGGTAATCCA	AAATCCTCAT	CTTGTGCCAA	GCTAACAGCA	2820
GTTTCAACTG	CTTGAAGAAG	AGAATTTTCA	TCAATGCCTG	CCAAAATAAA	TCCTGCCTTA	2880
TCTAAGGACT	CAGGACGTTT	TGTACTTGTA	CGAATACATA	CAGCGGGAAA	AGGATAACCT	2940
TGACTAGTAA	AGAACTACT	TTCTTCCGGT	AAAGTTCCCG	AATCAGATAC	TACAACAAAT	3000
GCATTCTCT	GTAACAATT	ATAGTCATGG	AATCCTAGTG	GCTCATGCTG	AATCACACGT	3060
TTATCTAGTT	TAAACCGCT	CTCTGTAGC	CTTTCTTTTG	ATCTAGGATG	GCAAGAATAT	3120
AAGATTGGCA	TATTATACTT	TTCAGCTAAT	TGATTAATTG	CTGTAAAGAG	AGAAATAAAA	3180
TTTTTATCTG	TATCAATATT	TTCTCACGG	TGAGCTGAAA	GTAAGATATA	ACCTCCTTTT	3240
TTCAATCCCA	AACGTTTCATG	GATATCTGAA	GACTCAATAG	CAGATAAATT	TTTATGTAAC	3300
ACTTCTGCCA	TAGGAGAACC	AGTTACATAT	GTGCGCTCTT	TAGGTAAACC	AACTCATGT	3360
AAACTTAC	GTGCATGTTT	AGAGTATGCT	AAGTTAACAT	CTGAAATAAC	ATCAACAATC	3420
CGACGATTAG	TCTCTCCGG	TAGGCACTCA	TCTTTACAGC	GATTGCCAGC	CTCCATATGA	3480
AAAATTGGAA	TATGTAAACG	CTTGGCAGCA	ATAGCTGATA	AACAAGAATT	TGTATCCCTT	3540
AAAATCAATA	AAGCATCTGG	TTTAATTGGA	TTTCAATTA	TGTATGAAGT	ATTAATAATA	3600
TTCCCTACAG	TAGCACCAAG	ATCATCTCCA	ACAGCATCCA	TGTATACGTC	CGGAGTGTCT	3660
AACCCTAAAT	TATCAAAGAA	AATACCATTT	AAATTGTAAT	CATAGTTTTG	TCCAGTATGT	3720
GCCAAAATAA	CATCAAATAA	CTTTCGACAT	TTAGTGATAA	CACTACTTAG	ACGTATAATC	3780
TCTGGACGTG	TTCCCACAAT	AATCAATAAC	TTAAGTTTGC	CATTATCTTT	AAAGTGAATA	3840
TCACTATAAT	CTGTCTTAAT	TTTCATTTAT	TTCTCCACTT	GTTCAAAAAA	AGTATCTGGA	3900

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TGTCCTAGGAT CAAATGACTC ATTAGCCAC ATGACAGTAA TTAGATTTTC TGTATCAGAA	3960
AGATTAATAA TATTATGTGC ATAGCCCGGT ATCATATGTA TTGCTTCAAT CTTATCGCCC	4020
GACACTTCAA AGTTCAGAAT AGGATACTCT TGACCGTTT CATCCAGCCC TATCCTACGC	4080
TCTTGTATTA AAGCAGACC AGAAACAACC ATGAAAAATT CCCACTTAGA ATGATGCCAA	4140
TGTTGCCCTT TGGTAATGCC AGGTTTAGAA ATATTAACAG AAAATGACC CGTATTTTCT	4200
GTTTTTAATA ATTCCGTAAG ACTACCTCGT TCATCTATAT TCATTTTATAG AGGAAACTTA	4260
AACTTATCTA CTGGTAAATA AGATAGGTAG GTAGAATACA ATTTCTTTT AAACGATCCC	4320
TGAGGAATTT CAGGCATAAC TAAACTATCA GGCTGTTTT TAAATGTTT TAATAGAGAG	4380
ACAATCTCTC CTAAGGTGTC ACGATGAGTC GTTGGTACGT AGCAGTAGTT TCCTGATGGG	4440
CTAGGTAAGA TTTGTAATCC ATCTAGATTA CAACGATGAG GATTTCTTTC CAATGCAGTT	4500
AGACACTCTT GTATCAAATC ATCAATATAC AGCAACTCCA ATTCTACACT TGGATCATTT	4560
ACTTGAATAG GTAAATCGTG AGCTAGATTA TAACAGAAAG TTGCTACAGC AGAATTGTAG	4620
TTAGGACGGC ACCACTTCCC ATAAAGATTC GGGAAACGGT AAACTAAGAC AGGTGCTCCC	4680
GTTTTCTTTC CATATTCAAA GAAGAGTTCT TCCCCTGCTA GCTTAGATTG TCCATATATA	4740
GAGTTTGAAA ATCGGCCTTC TAAACTAGCT TGAGTAGAAC TTGAGAGTAG AACAGGACAA	4800
GTGTTTTCAT ACTTTTCTAA AATCTCCAAT AATCTACTTG AAAAACCGTA ATTTCCCTCC	4860
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CCAATCTCTA AATTAGGACG AGTCTATCT CGTCCATCTT TCAAAGCTTC CAGAGTACAG	5040
ATAAGATTTT TTCCTACAAA TCCTTTCGCT CCTGTGATTA AAATATTTT AATCATGCCC	5100
CCTCCTTATT TTATATGCTG TTTAATAGT TAACTCTCTC GACAATACAT GATACATTAT	5160
ATATCCTTGA TAATTTAAT GTATCTTAAA AGATTTTACA TCTCTTCGTC TGCTACCATA	5220
TCACGAATTG CTGTCTGTAT TTCACTAAT TCTAGCAACT TTCTTTTAAAC TTGCTCTACA	5280
TCCATCAAAT CGGTATTATT ACTATTGAAT TCTGTCAACA AATTTCTATT CGTACTACCA	5340
TCPTTGAAAT ACTTATCATA GTTAAGATTA CGATTATCAC TAGGAACTCT ATAAAAATCA	5400
CCCAAATCAA TTGCATTTGC GCACTCTTCG TTAGTTAATA GTGTTTCATA CCTTTTCTCT	5460
CCGTGTCTAA TACCTATAAT CTTAATATCT TGTCTGAGG CAAAAATTTC TGATACAGCC	5520
TTAGCCAACA CTTCAATCGT ACATGCTGGT GCTTCTGAA CTAGTATATC TCCAGATTTC	5580
CCTTCTTCAA ATGCAAATAA AACCAAGTCT ACTGCTTCTT CCAATGTCAT CACAAAACGT	5640
GTCATGCTAG GTTCAGTAAT TGTAAGAGCA TTTCTTCTGCT TAATTTGCTC AATCCAAAGA	5700

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GGAACGACAG ATCCACGGCT ACACAGAACA TTCCCATAGC GAGTCACACA TATCTTTGTA	5760
TGCTCAGGAT TTACCGTCCT GGACTTAGCA ACAGCAATCT TTTCCATCAT AGCCTTGGAT	5820
GTTCCCATAG CATTGACAGG ATAAGCCGCC TTATCTGTAG AAAGACAGAT AACTTGCTTT	5880
ACACCAGCTT CGATAGCCGC AGTGAGGACA TTCTCCGTTC CCAAATGTT AGTTTTTACC	5940
GCTTCTACAG GGAAAAATTC ACAAGAAGGT ACTTGTTTAA GAGCAGCAGC GTGAAAAACA	6000
TAATCCACAC CATGCATAGC ATTTTTTACC GAAGCTAAGT CACGCACATC TCCAAGGTAA	6060
AAACGGATTT TCCCAGCCAC TTCTGGTACT TTTACCTGAA ACTCATGACG CATATCATCT	6120
TGTTTCTTTT CATCTCGCGA AAATATACGA ATCTCTGAGA CATCTGTTTC TAAAAACGC	6180
TTGAGAACCG CATTCCCAA TGAACCTGTC CCTCCTGTAA TTAGGAGAGT TTTTCCTGTA	6240
AATTGTGACA TATATTACAC TTCTCCTTCT AGTATGTCTG CAATTTTCTT ACAAGCCGTT	6300
CCATCTCCAT ATGGATTTGA AGCTTGACTC ATTGCTTGAT AAACCTGAATC ATTTTCTAAT	6360
AATTCTTTAA AATGCTATA AATATTATTT TCATCAGCAC CTACAAGTTT CAAAGTCCCT	6420
GCTTCAATTC CCTCTGGACG TTCAGTTGTA TCTCTCATAA CCAAAACAGG TTTTCTTAA	6480
CTTGAGGCCT CTTCTGAAT ACCACCACTA TCTGTTAAAA TTAATAACT TCTTGATAAA	6540
AAATTGTGAA AATCTAATAC TTCTAAAGGT TCGATCATCT TGATACGTTC ACAGCCACTT	6600
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ACATCTGAAT ATTCTTCAAT AATCCTTCTA ATTGCTCTAA ACATATGTCT CATCGGTTCA	6720
CCAAGATTTT CACGACGATG AGCTGTAATT AGAATAAACC TGCTTTCTCC TATCCATTCT	6780
AACTCAGGAT GCGTATAGTC CTCTTGAATT GTAGTTTGTA AAGCATCAAT CGCCGTATTA	6840
CCTGTCACAA ATATGCTCTC TGGAGTTTTT CCTTCTCTTA AAAGATTATC TTTTGAAAGT	6900
TGTGTTGGTG TAAATGATA CTGAGCCAAA ACCCCAAGT CTTGACGATT AAACCTTCA	6960
GGATATGGTG AATAGATATC GTAAGTGCGC AAACCAGCTT CAACATGACC AATTGGAATC	7020
TGTAAATAAA AGGCCGCCAG TGAAGTAGCG AAGGTCGTAC TTGTATCCCC ATGAACTAAC	7080
ACCAAATCAG GTTTTCTGA CTCTAAAATA GCCTTCATTC CTTCCAAAT GCCAATGGTC	7140
ACATCAAATA AAGTTTGTPT ATCTTTCATA ATAGACAAAT CAAAATCGGG AATAATCCCA	7200
AATGTGTCCA AGACCTGATC CAACATTTGA CGGTGTTGGC CCGTAACGCA AACTAATGTT	7260
TCAATATTCT TACGTGTTCT TAACTCTTTG ACCAAAGGAC ACATCTTGAT GGCTTCTGGA	7320
CGAGTTCCAA ATACTACAAC TACTTTTTTC ATATATTAC TTAATCCTAA CAAATAATGA	7380
ACGGTCTTA AAATAAATTA GATAACGGCT AATCCATAAC ACCACCTCAG ACATACTGA	7440

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ACAAATAGCT AATGTTACTA AACTAAAATT ATCAGACAAG ATAAATATTC CTAATCCCAA	7500
AGTTTGGACA ATCGAAGCTA ATATAGTTGT CATTGTAGTT TCTTTCACCT TATCAATAGC	7560
TCCTAAGACA GGCCATCCGT AAATCATAGA ATAAAACTA GCAACAAAAG CGGGTAATAA	7620
GTACTTAAGA AAATCTGCTG AAACGGTATA TTTTTCACCA CCAATTATAG AAAGAATTG	7680
ATTTGAAAAG AATAAACTA TCAAACTCC AAAGATAATA GGAATAACA TAATCCGATT	7740
AATACTCTTA ACCGATTGTA TATCTTTAGT ACGTATCATA TGCGGATATA AACTATTGCG	7800
TATAGGATTA TACAATGATT TTGCTGCTGA AAGCAGTTGC ATTGCTATCC CCCAAAAGGC	7860
TATCTCTTGA CTTTGTAAAT AAAAACCCGA AATGACTGTC GTAAAGACGC CAAAAATAGT	7920
AGTTGCAAAA TTGGATAAAA AATAAATAGA GGATTCCTTT AAATCTTTAA CCCAACAGA	7980
CAGATAAGAA AATGATAATT TAATCCATA ATAATGAAG AATCTATAAG AAACACTGTC	8040
AGCAACTAAA TTCCCAATTC CTTCCAATAT AGGAATCCAT AAAATAGAAG AATCATCTTT	8100
TACTACAATA AATGTCAAAA TTGTAATGAT AGTTTTAGAA ATAATATAAG GAATTGCAAC	8160
TGCATGCATC TTTTCAATTC CACGAAATAA AAAGTCAAAG ATAAAAATAT TGGTCACTGT	8220
AGCTAACAAA TAAAAAAGT AAAAAAGAAT ATTCTCTCTC ATTATGGGA TTGCCACAT	8280
CAATATGGTG TAAATTAGAA TCGAAATGAT AGATAAAAAT ATTTTTTCAA CTAGAGTATC	8340
TCCAATATC CTTCCAATCT TTGAGGGAGT AGTACAAGCA TTTACAATAT TTTTGTAGC	8400
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AGGAAATAGT AATTTAACAA TATTCAGAAT ATAGAGAGAA CTTGTATTTT TTATAAATGA	8580
AATTCTATCA ACTTTCACGA ACTAGTCCTT CCAAAAAAAG ATCTAAATAG TCCAACTAC	8640
TTCTCGCTTT CAACACCAAT TCTGAAGTA TTGTTATCGG TTTTAGATGA AAAGTTTCAA	8700
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TATTAAACA TGTGCCACT ACCCAACAT GTAATTTACA AGTTAAACC ACATCTACCA	8880
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CTTCTCTTTT CAATTGACAC AGCTGCTCTG TTTTTCCTTC TCTTAATTTA CTTGAAATAA	9180
TTAAATCAAA GGTTCATGC ACTGGAGCCG AAGGCGACAA ATGCTTCAAA GAATCAAATG	9240



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ATTCTCGATC ACGAACTGTA ATAAATTGAG CATGATTAAT AATTCTCTTT ATACCATAAT	9300
TCATCAAAGA ATCGTTATTA GGCCCTGCAC CAATACCTAA TACTCCTATA GGCTTTTAA	9360
AATATGAAGC CCAAATCCC AAAGGTAAAA ATCGTTTAAA TTGGATTAAA TTATCACGAA	9420
AACGTGCATT ATGCCCTTCC CCAAAATATC CTCCCGGGAT ATACAAAATA GCATCTGCTT	9480
GTTTTTTAGT AAAACTTTGT TTTTGGCGAT ATTCTTTCAA GTACATTTGA AAGAAATCTG	9540
ATGGATTATA AAAAGAACT TCATATCCTT TAGATTCTAA TAAATCATAG ACAATCTCAC	9600
CGTAAAGATA ATCACCCTAA TTACTTGAAC CATAATCCGT TGCACCATGT AACATAATT	9660
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CGCTGATGCT TTATCAAAAA AATCACCAAC TAACCATCCA ATAGGAAAAA TTGATAGGAT	10020
AGTGCCTAGA AATGTCATCC CATATTCATA TGGAATGCTA CTAGGCACAA CAGTTACAGC	10080
AGAAGCTACT GTTAGGCTGG TCAGTCCCGA CTCTGAAAAT ACTTCCCCTA GTATATTCTT	10140
TACAAAATCT AATGAAGAAA AGGAATCAAA TAAGTATATA CCTATAGTAT TCAAGTCGAA	10200
ACGGTGCCCC CTAATAACAA CTAATACATT TAATAGAAAT ACAGTTACTA TTAAAAATAC	10260
AAGTACTCTT TTCTTCGAAA AAGTAATCCC TAAAGATTGT GTGTATACTA AAACCAACGC	10320
CAAGATTGAA AACACCTGGA TTTTACGACT TCCTGTTAGG ATCATTATCA AAATTAGGTA	10380
AAACAACATT ACCCAAAAA TAGTACGCTT TATAACTCGG GACAGCTTAT CTGAATAAAA	10440
CAAGGAGAAC ACACCAGGAA GCATAAGTAC TCCTAAATCA TCTATTATTC CTGAACTAGC	10500
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AGTTATTACC CTAGAAATA AGCCCACTCC TGTTAAAATC CTACCCGCAT TGTACAAAAT	10620
TTTCTCTTCA TTTTCTGAT AATTTTGTAC TTCTGAATGA TAATGTACCT TTCCATCACT	10680
ATAAAAAAT AAATAGCCTA CAGAATAACA AAACAAAATC CAAATTATAA AAATATATGA	10740
ATGAAATAAT TCTTCATTAT TATAGAAGTT ACTAGGGCTC CACAGCAGAG TTGTTTGAAA	10800
CCCCATATAC TCATTGAAAA TTAATCCAAA CATAAAAAA TAAGATAAAA TCAGATACCA	10860
TACAGAAAA TCATATATAC TAACTTTTTG TAAATAAAA CCAGTAATTT GAAAAATAAT	10920
TAGAAAGCAA ACCCATATA ATATAGACGG AACATAATTA GATATAAGAA AACCATTATT	10980

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CCAAATTATCG AGAGTCCAGA ACAAGTAACA GAAAGCAAAT ATAAACTTA ATGTCAC TAG	11040
TGTCACCTA CAAATATACT TTGTCTGCAT CTATATCTCC TTTATTACAC ACATTTCTTG	11100
ATAACGATTC AATAATTTAC TAGCTTGATA ACAAATATCA TAGAGTCCAT CTGTCATACT	11160
GTTATTTATT TCAAAACGAT TGCATTCTC AGATGTTAAA GACAGTACTT TATCTTTCCA	11220
TAGCAACACA GACTCTTCGT TGATAGGTAA GTAACAAATG TTTTGGTCA CATCTACTTC	11280
TTGCGTCACT GTATCTGACG ATAAATTTG TAATCCCGAT GCCTGAGCCT CTACTAGAGA	11340
AACAGGCAAC CCCTCATATT TAGACGGAAG CAAAAAACA TCCATCGCAG ATAATAAATC	11400
AGAAATATCA GTCCTTCTCC CTAAAAATAG CACATATGGG GTCAGATTTA GTTCTAAAGC	11460
TTTCTGTTTT AATTTCTGCT CATCCTCACC ATTACCAACT AGGAGTAAAA TAACATTTGG	11520
TTTGATTAAA ATGAGTTCTT TTTAAACGTT AAATAAATAA CTTTGGTTTT TTTGATCTGA	11580
TAGGCGAGCT ATATTTCTTA ATACGAACTT ATTTGACACA TCTAATCTC TACGACATTT	11640
TTCTCTAACA TCTGACAAAA ATTGATACTT TTTCAAATCA ATTGCATTAA AAATAATTTT	11700
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AATTATTTTA GATAAGATCA GACCAATTGC AGATTTATAG CCATGGCAAT GAACTATATC	11940
ATAATCTCCT TTCTTTATTA TTCTAGCAAG AGAGAGAAAC TGATGTAGAG GCTTTTCTCT	12000
TAATAGAGGC ACATGATAAA CCTTTGCACC CAATCTTTC ATTTTATCCT CTAAAAATCC	12060
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ATAGTTGAAT AGAAAACCTT CTACTCCACC ACTATCTAGT GTTGTAATA GATGTAATAC	12180
TTTAATCATT CTCTTCTT AAGCTTAAGA TTCGCTTCTC TAATCTATT TCTGTTTTTT	12240
GTMTTCTAA ACTAATCTG TCCATGAAGT TATCACAATT CTTAATTAGC TGTTCCTGT	12300
CAAGGTTTTG AATATACAAA GCCAAACAAT CTTTTCCGA TTCATCCTTC ATAGGTAAAA	12360
CGAAACCAA ACCATCTCT ATTGACACTT TTTCCATATA AGTATCTTCA CAACTAAAA	12420
TAGGTTTATA CAACAATGCA GCAAAGTAGA GTTTATTAGA CAAAGCATAG TCTAGTAAGG	12480
GAGTGTGATT CCCGTATAAA TTCAAAACAA CATCTGTATT CTTATAAAAA GACATGGTAT	12540
CTTAGGCTG GAATGTGTCC ACCAAGTTAA CATTGCTGAT ATTTTCTTCT TGACAAAATT	12600
CCCTTAATTC TCCTGCATTA GTACCTATAA AATCAACTG AAATCGACTG TCATTGCAA	12660
AAAAATCGAT TATTTTTTTA TTTTGTCTT GAAAACGAAT TAAACCAATG TAGGAAAGTT	12720
GAATTGAAA CGTACTATTA TTTTAACT GCTTACCTC GTTTAATTCT ATCATATTGG	12780

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GTAGGTTATG GGTAGTAAAA TACTCTCCCA TTGGTAAAAA AAATTTATAG CCGTCTGAAG	12840
AAACGATATT CATTAAGAA TTTTTCACCA ATTGTTTCTG AACCAAACGA TAAACCAAAA	12900
ATTTTTCATA ACTGTAATCA CGAATATCAT AAATATATCT ATTTTAAAT GAAAAGAGAA	12960
GAAAATCTAC TAAAATGAAA GACACAATAC TATGTAACGG CAATATCATA TCATAATCAT	13020
TTTCTTTTAG CTCTTTTTA ATTTCTTTTC TGAATTTTAC ATAACCTAAT ATCTTACTTA	13080
ATTTTCCTTT ACCAGAAAAA GAAATACGAT AGTAGTTTGG TTTTGTAAATA ATCTCGTTAA	13140
TATTCCTTATC CCAATATATA ACATCGTAAC TAATAGACAG TTTCTTCAAT AATTCTTTAT	13200
AAAAATGAA GTAAGGAGTT AGATATATAT TATCAGATAG TATAAACAGT ACTCTCATTA	13260
AATTATTCTT TCTTACTTTC CCTCTCTAAA CATGTCTCCA GTTCGAGCAT AAACCTGCTCT	13320
TTTGAAAAGT GATTTTCATA GTAACAACGA GCTTTCTTTC CTAACCTCTCT TTGTCTCTTA	13380
ATAGATAACA TACTAAATTT ACAATATTTT TTGCCAATT GTTTTACATC TCGTTCGGGA	13440
CTAACATATC CACAATTGTC TTCTTCTACA ATTATTTTAG CATCTCTGA AATTGCACCT	13500
ATAATTGGTT TGCCTGCCGC CATATAAGAK TGTACCTTCC CAGGTATAGT ACGAGAACT	13560
ATCGAGTCTC CTATTAAAGA AACTAACATA GCATCTGATT TTTTATAGAA GGATGGCATT	13620
TCCTCCAAAG AACGTCTTCC ATAGAAGGAA ATATTCTTTA ACTCCAATTC ATGAGCTAAT	13680
GCTTTCATGC TTAACAATTC CGTACCATCT CCAACAAAAT GAAAATGAAT TTTCTTGGGT	13740
AAATTGGTAT TCTTCTCTAT CAACTGGCA GCTTTCAAAA TAGTTTCCAA ATTTTGTGCT	13800
TTGCCAATAT TACCAGCAAA AGTTAGGTCA ACACCTTCTT TATTAACATAT AGATTCATCA	13860
GGGATAAAAA GATCTTCTGC ATATTGTGGC AAATATGTAA TCTTTGTTC GGATATGTCA	13920
AATTGCTTCA CAAAATAATT TTAAATGAT GGACTAGTGA CAAATATATA ATCACTAGCT	13980
CGGTAAACTT TTTTGAGAT AAATTTAAAC AGCTTGAAAA TCAAGCCATC TTGTTTCACT	14040
CCACCTACGG TTAAACTATC TGGCCAAACA TCCATACAAT ATAGAAACAT CGGTTTCTTA	14100
TATTTTTTTT TATAAGCCAT ACCAGCCCAT GCCATCATAA CTGGAGACAA TTGGTTAACG	14160
AATACACAGT CAAAATTCGA TCCATCTTTC GTTTTATACC TCCCAATAA AACTCCTAAA	14220
GTAGAACTAA TTGCAAAGCT AAAATAATTC AACAAATCGAA ATACAACACT TTTTTTCTA	14280
GGGATTGTAT AAGAACGATA TATCGTAACA CCTTCTATAA TCTCACGTCT TTTTTTATTA	14340
TGACGATAAT CTGCATATAT CTTCCTTCA GGGTAATTAG GAATCCCAGC CAAAACAGAG	14400
ACTTCATGCC CTTTTCGAAC TAAATCTTCA CAAATATCTG ACAACCTGAA TGGTCTGGC	14460
TTATAATGTT GGCAAACAAA TAGTATTTTC ATTGTCCAAT TTAACCTTCT TTCTTACCAC	14520

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TACCCCTCTAC AATACCTTTT CGTTTCAGTA CGTAAGGTAT TGTCTTAACT ATACATCTAA	14580
TATCCATTAT CAAAGACAGA TGTTTAACAT AGTAGCCATC TAACTCCGTC TTCATCTCAA	14640
CAGACAAAGT ATCAGCCCCG TTAATTTGTG CCCATCCAGT TAACCCTGGC AAGATATCAT	14700
TTGCTCCATA CTTATCTCTC TCTGCAATCA AATCTAGTTC ATTTATACCC GCTGGTCTAG	14760
GACCTACAAT ACTCATATTA CCAACAAGAA TATTAAACAA TTGTGGTAGT TCATCCAAAG	14820
ATGTTTTTCG CAAGAAAGCC CCTACTTTTG TAATCyATTG CTCTGGATTA TATAAGTTTC	14880
GAGGCGCCAC ATTTTTAGGT GCATCTATTT TCATAGACCT AAATTTCAAA ATATAGAAGT	14940
ATTCTTTATG AATACCAAAG CGTTTTTGCT TAAATATAAC CGGACCTTCT GAATCAAGTT	15000
TAATCGCAAT TGCAATTATC ATAAAAACCG GACACAATAT TATTATCCCT ATTAAAGATA	15060
ATAATATATC ACCTAATCGT TTTATTATAC CGTACATAAA CAACCTCCAA CTATAAATTC	15120
TATTTCCATT TTTTCATTCTA TTTCATTG ACAAATTAAC TCAGGCAGTA CATGCAACTA	15180
CAGAACTCA ATATATATTT GGTCACTCAA TGATTTTCAG AAATATAATT CTTTTATCCT	15240
CTACGTCAGA TAAAACTTTT CTCCATCTAA ACAAATTTA TTGTGTTTCAG TAATATATGA	15300
GTTCTCAATA ATGAATTAGA AGGTCCAGTT CAATTATTCT TCCAAATAGA CCGAATATTA	15360
TTTGAAGACA TATCGGTTTC TGAAATTGCA ATCAGTACAT AAGCTAATAA ACTGATAAGT	15420
ATGCTCTGTA AGAATGCCAG AGTTATATTG TAGTCCCCTT CCATACTATA TTCATTTTAT	15480
TTTTTACCAT AATTTCCATA GGAACCGTAA ACTCCATACT TATTAACCGA GATATCCAAT	15540
TTATTTAAAA CAACTCCTAG GAACAGTTTC CCTGTTTGT TTAATTGTTG TTTCGCTTTT	15600
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TGAGTGATAA TTGCCGCATC AATAACAATT CCAATAGGCG GTGTATCAAT AATGATATAA	15720
TCAAAATATT TACGCAATGT TTCAATCATA TCATTAAAAT TTTTACTTTG TAACAAGGCT	15780
GTAGGGTTTG GTGATACAGA TCCCGATTGA ACTACAAATA AATTTTCAAT ATTTGTATCA	15840
CATAAACCGT GAGATAAATC AGCTGTCCCA GATAAAAAAT CTGTTAGCCC TGTAATTTT	15900
TCACGAGATT TAAAACTCC TAACATAACT GAATTTGAG TATCGCCATC GATCAAAAGA	15960
GTTTTATAGC CTGCACGCGC AAACGACCAT GCTATATTTA TGGAAGTAGT TGTTTTTCCT	16020
TCCCCAGGGT TAACAGAAGT AACGGAAATT ACTTTTAGTT TATCTCCGCT CAACTGTATA	16080
TTTGACACA AGGCATTGTA ATATTCTTCT GCCTTCTTAA TGAAGTCCAG TTTTTTTGT	16140
GCTATTTCTA ATGTCGGCAT CCTTCTCTCC TATTTCAACT TACCCAAGTT TGGCACAAC	16200
CCCAAAAGTG TCATCTGCAA TGTATTTTCG ATATCTTCCG GACGTTTCAC ACGAGTATCC	16260
AAAAGTTCAA GATGAAGAAC TATAACACTA GTTCCAATCA CCCCTGCCAA AAAACCAATT	16320

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AGTGTATTGC GTTTAATATT TGGCGAAGAC GGGGATATCG CCGGCCTTGC CTCCTCCAGT	16380
GTTGTACAGT CAGAAACACG AGTAATACTG ATAATTTTTT GAGCAGCTAC TTCTCTCAAA	16440
GAGTTAGCGA TACGGCTTGC CTCTTCAGGA ACTCGATCAT TAACTGAAAT AGAGACAATA	16500
CGGGTATCAA CTGGTACTGT CACTTTAATF TTATTAGCCA AACCTTTTGG CGTCAAATCT	16560
AGTTTCAAAT CAGAAACAAC TTCCTCCAAA ACATCCTGCG AAAGGATAAT CTCACGGTAG	16620
TCTTTTACCA GATAAGTTCC TGCCTGCAAA TCCTGATTG TCAACCCCGG CTGTCTCCT	16680
TGATTGCGAT TCACTACGTA AATTCGCGTG GTACTCGTAT ATTCTGGCTT AACAAATAAA	16740
GTGCTATATG CAAAAGCCCC CGCACCTGTC ACAAGTGCCA CTATTAAAT CATTAGCTTG	16800
CGTTTCACA AGCTTTTAAC TAATTGAAAT ACATCGATT CTATCGTAT TTGTTCTTTC	16860
ATCATTCTC CTAAATTAGT TGATCCATTA CAATTTTTCG AGGATTGTCT ATAAAAAGTT	16920
CCTGAGCCTT CGCTTCTCCG TATTTTGGG TAACAAGGTC ATATGCTTCT GCCATATGAG	16980
GAGGTCTACC GTCTAGATTG TGCATATCAC TTGCAATGAC ATGAACCAA TCCTGCTCTA	17040
AAAAACTG AGCTCTTTT TTCATGAATT TATAACGTT GCCAAAAAGT TTGGGTTTGA	17100
GGACATGTGA ACTATTACT TCGGTGAAC AGCCCATATC GATCAGTTCT CGAACGCGTT	17160
TTTCATTAT TTCAAGAGCA TCATAGCGCT CAATGTGGGC AATGACTGGA GTAATTCCCA	17220
ACATCAAGAT CTGCTCAAG GCGCTATGAA TATCGCGATA AGGAGTGTTT AACTAAACT	17280
CTATCAAGGC ATAACGACTA TCATTGAGGG TCGGAATCCG CTTTTTTTCC AGCTTATCCA	17340
GAACATCTGG TGTGTAATAA ATTTAGCCCC CGTAAGCAAT GACCAAGTCA CTCGCCACTT	17400
CCTTAGCTAT TTCCCGAACC TGAAGAAAGT TTTCTGCTAT CTTCTCTTCC GGAGTTTCAA	17460
ACATGCCCTT GCGACGGTGA GAGGTAGAAA CAATGGTTCG CACCCCTGT CTGTAGGATT	17520
CTGCCAAGAG AGCCTTGCTT TCCTCTCTTG ACTTGGGACC GTCATCTACA TCAAAAACGA	17580
TATGCGAATG GATGCTATC ATTTTCATCTA CCCTCCATCA CATCCTGTAT AGCTGCTTTA	17640
ACTACAGCTA AACTACTATC ATCTATTTCC ATCACATAGA GGTACTGTC TGGCATTGCA	17700
TAAGAAGGAA GATCCATCCG ACCTGTCCCT TTAAATCTT GAGAATTTAC TTTATAATTC	17760
CCTCCACTTT CTAAGTACG ATTGACCAAA TTTATCATGG TCTCAAGTGG CATATTTGTT	17820
TGGATAGAAT CTGCAAGCT ATTAATGATC GTACTATAAT TTTTCAGCAC TTCGGTTGAC	17880
GTAAATTTT GAAGGATAGC CACAATCACC TTTTGTGAT GGCGCCCGG GTCACGATCG	17940
CCATCTGCTA GGGAGTAGCG CTCACGAACA AAACCGAGAG CCTGTTCTGA ATCAAGATGA	18000
ACATTGCCCTG CAGGGTAATA CTTTCCATTC GTATGGGCAG TAAATCTTG ATCATTATAA	18060

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ACATCAATTC CACCCAACAA ATCAATCAAT TTCAAAAACG AAGTGAAGTT CAATCGCACA	18120
TAGTAATTGA TATCCACTCC ATAGAGATTT TCTAAGGTGT GAATGGACGA ATCAACTCCA	18180
TAAATGCCCG CATGAGTCAA TTTATCTTTT TGATTATTTT CACCATCTGC GATTGGTACA	18240
TAGGCATCAC GTGGCGTTGT GGTCAAGAGG ATTTTCTTGG TATCTCGATT GACAGTCATC	18300
AGGATGTTGA CATCTGATCG CGACACCGAA CTAATAGGAC CATAGGTGTC AATTCCACTA	18360
ACATAGATAT TGAAAGACTG ACTCTTAGAC GTCTTAGGAG CTTCTACTTT TTTAGTGAAT	18420
CCCTTAGTAT AAATCTTTT TATCTTCGAT GCGTAGTCTG GATACTCTGA CTCGATGATG	18480
TTTTCAAAGA CACTATTTAG GACAATGGCC TTAGTCTCCC CTGCAATCAA ACTCTTGTA	18540
GCTGCCAAGT AAGACGAACT CTGGTTGACC GTCAAATCGG TATTCTGACT TGAATTGATA	18600
TCAGCTAGTA ATTTCTGAAT ATTTTCATTA TTAGTCCCAG TCGGTGCTGT CACACTCGTC	18660
AGTTGCGTAA CATTTTCGAT CTCACTATCT GCTAAAACAG CGACACTGAT TGAATATTCT	18720
GAGTAATTAG AAGTCGCATT TAAACGATTG GTCAGTCCAA CAAACTGCTG TACTGCAAAG	18780
AGCGACACAG AGCTGACAAG GATAGAGAAC ACCAACAGAA AAATAGTAAA CTTTTCAGCT	18840
TTTTTATAGA TAATCAAGAG TAGCCCTACC AAGGCAACTA GTAGGACTAA CGCAGTTACC	18900
ACTAGATTAA GATATCTAAA AGCAAGGATA TTGTACTTAA AGATTAAGAA CAATAAAAAA	18960
CAAATAACA AATAATAAAT AGTCAGCAA ACTATATTAA CACTTCGCTT CACTTCTGT	19020
GAACGTGATT TTTTAAAACG TCTACTCATG ATTAATACCT ATACATTGAA CATTATACGA	19080
TTATATCACT TTTTACGGT AATGTCTACA CCTTTATTTT TACTATCTGC ATCTTTAAGT	19140
ATCTTAGTAG ACTTCCCGC AAACAAAAT ATAGTAAAAT GAAATAAGAA CAGAACAAAT	19200
CGTTCAGGAC AGTCAAATCG ATTTCTAACA ATGTTTTAGA AGCAGAGGTG	19250

## (2) INFORMATION FOR SEQ ID NO: 36:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 21706 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO: 36:

AAAGTTGAAA GACTGCTAGC TGTTTTTGAT ACCAATCGTT TCCAACATA GAGCAAACAG	60
TATACAAAGT TTGTTTTTGG ATGTAAGCTT CTTGATGGAC AATTCCAAGA AAATCAAGAA	120
ATTGCTGACC TTCAATTTT TGCCATTGAC CAACTGCCGA ACTTATCTGA AAAACGCATT	180
ACCAAGGAGC AAATAGAGCT TCTTTGGCAG GTTTATCAAG GTCATAGGGG GCAATATCTT	240

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GACTAAGAAG ATGATTATCG TATTTCCTAAA TCCATTTTAA ACAACTAGCA TGGTATAATA	300
ATATGCAGGA AAATTTTGAA TTATGAGGAA GACTAGATGA ATTTATGGGA TATTTCCTTT	360
ACGACTCAGG CAACCGAGCC GCCCAAATTT GACCTTTTTT GGTATGTTAG CCTATTTACG	420
CTCTTAGCCT TAACCTTTTA TACAGCCCAT CGCTATCGTG AAAAGAAGGT TTACCAACGA	480
TTTTTCCAAA TCTTCAGAC TGTTTCAGTTA ATCCTTCTTT ATGGTTGGTA CTGGGTCAAT	540
CATATGCCAC TGTTCAGAAAG CCTACCCTTT TACCATTGCC GTATGGCTAT GTTTGTGGTA	600
CTCTTGCTTC CTGGTCAATC CAAATATAAA CAATACTTTG CATTATTGGG AACATTGGG	660
ACATTAGCAG CCTTTGTTTA TCCAGTGCCA GATGCTTACC CTTTCCACA TATCACCATT	720
CTATCCTTTA TCTTTGGTCA TTTAGCACTC TTGGGGAAC CTCTAGTTTA TCTATTGAGA	780
CAGTATAATG CGCGATTGCT GGATGTGAAG GGAATTTTTC TCATGACCTT TGCCCTAAAT	840
GCCTTGATTT TTGTGGTCAA TTTGGTGACA GGTGGCGATT ACGGATTTTT GACAAAACCG	900
CCATTGGTTG GGGATCACGG TCTAGTAGCT AATTATTAC TTGTTTCAAT TGTGCTGGTA	960
GCTACTATCA GTTTGACTAA GAAAATCTTA GAATTCCTTT TAGCTCAAGA AGCAGAAAAA	1020
ATGATTGCAA AGGAAGCTTA ACACAGAGCT TTCTTTTTTG CTCTTAGAGA GTTTTACAA	1080
GCAGCTTATA AAATAAGAAT TTCTGAATAG ACAAACTCAA AAAATGGCTG GGAATTTAG	1140
GAAAAAGCA AGCACGATTA AATTTTGT GTTATAATAT TTTGTGAATA GCTATGCCTA	1200
TGTTTAGCTA TGGGAATAATA CGAAGTCCGA AACTTGAAG ATAGAGAGGA AGCGATGTAA	1260
TGGCTAGAGA AGGCTTTTTT ACAGGTCTAG ATATTGGAAC AAGCTCTGTC AAGGTGCTTG	1320
TGCCCAGCA GAGAAATGGT GAATTAATG TAATTGGCGT GAGTAATGCC AAAAGTAAAG	1380
GTGTAAAGGA TGGAAATATT GTTGATATTG ATGCAGCAGC AACTGCTATC AAGTCAGCCA	1440
TTCCCAAGC GGAAGAAAAG GCAGGCATTT CGATTAAATC AGTGAATGTC GGCTTGCCTG	1500
GTAATCTTTT GCAGGTAGAA CCAACTCAGG GGATGATTCC AGTAACATCT GATACTAAGG	1560
AAATTACGGA TCAAGATGTT GAAAATGTTG TCAAATCAGC TTTGACAAAG AGTATGACAC	1620
CTGACCGTGA AGTCATTACC TTTATTCCTG AAGAATTTAT TGTGGATGGT TTCCAAGGGA	1680
TTCTGACCC ACGTGGCATG ATGGGGGTTT GCCTTGAAAT GCGTGGTTTG CTTTATACAG	1740
GACCTCGTAC TATCTTGCAC AATTTGCGTA AGACGGTTGA GCGTGCAGGT GTTCAGGTTG	1800
AAAATGTTAT CATTTACCA CTAGCAATGG TTCAGTCTGT TTTGAACGAA GGGGAACGTG	1860
AATTTGGTGC TACAGTGATT GATATGGGGG CAGGTCAAAC GACTGTCGCT ACAATCCGTA	1920
ATCAAGAACT CCAGTTCACA CATATTCTCC AAGAAGGTGG AGATTATGTA ACTAAAGATA	1980

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TCTCCAAGGT TTTGAAAACC TCTCGCAAAT TAGCGGAAGG CTTGAAACTG AATTACGGGG	2040
AAGCCTATCC GCCTCTTGCA AGCAAAGAAA CCTTCCAAGT AGAGGTTATT GGAGAAGTAG	2100
AAGCAGTCGA AGTGACGGAA GCCTACTTGT CAGAAATTAT TTCTGCACGA ATCAAGCACA	2160
TCCTTGAACA AATCAAGCAA GAATTAGATA GAAGGCGTCT ATTGGACCTC CCTGGTGGTA	2220
TTGTCTTAAT CGGTGGGAAT GCCATTTTAC CAGGTATGGT TGAGCTTGCT CAGGAAGTCT	2280
TTGGCGTCCG TGCAAGCTT TATGTTCCAA ATCAAGTTGG TATCCGTAAT CCAGCCTTTG	2340
CGCATGTGAT TAGTTTATCA GAATTTGCGG GTCAATTAAC AGAAGTTAAT CTTTGGCTC	2400
AGGGAGCGAT AAAAGGTGAG AATGACTTAA GTCATCAGCC AATTAGTTTT GGTGGGATGC	2460
TGCAAAAAAC AGCTCAGTTT GTACAATCAA CGCCTGTTCA ACCAGCTCCT GCTCCAGAAG	2520
TAGAGCCGGT GGCCTCTACA GAACCAATGG CGGATTTCCT ACAAGCTTCA CAAAATAAAC	2580
CGAAATTAGC AGATCGTTTC CGTGGATTGA TCGGAAGCAT GTTTGACGAA TAAAGAGGAA	2640
AAATAAATTA TGACATTTTC ATTTGATACA GCTGCTGCTC AAGGGGCAGT GATTAAAGTA	2700
ATPGGTGTCG GTGGAGGTGG TGGCAATGCC ATCAACCGTA TGGTCGACGA AGGTGTTACA	2760
GGCGTAGAAT TTATCGCAGC AAACACAGAT GTACAAGCAT TGAGTAGTAC AAAAGCTGAG	2820
ACTGTTATTC AGTTGGGACC TAAATTGACT CGTGGTTTGG GTGCAGGAGG TCAACCTGAG	2880
GTTGGTCGTA AAGCCGCTGA AGAAAGCGAA GAAACACTGA CGGAAGCTAT TAGTGGTGCC	2940
GATATGGTCT TCATCACTGC TGGTATGGGA GGAGGCTCTG GAACTGGAGC TGCTCCTGTT	3000
ATTGCTCGTA TCGCCAAAGA TTAGGTGCG CTTACAGTTG GTGTTGTAAC ACGTCCCTTT	3060
GGTTTTGAAG GAAGTAAGCG TGGACAATTT GCTGTAGAAG GAATCAATCA ACTTCGTGAG	3120
CATGTAGACA CTCTATTGAT TATCTCAAAC AACAAATTTGC TTGAAATTGT TGATAAGAAA	3180
ACACCGCTTT TGGAGGCTCT TAGCGAAGCG GATAACGTTT TTCGTCAAGG TGTTCAGGG	3240
ATTACCGATT TGATTACCAA TCCAGGATTG ATTAACCTTG ACTTTGCCGA TGTGAAAACG	3300
GTAATGGCAA ACAAAAGGAA TGCTCTTATG GGTATTGGTA TCGGTAGTGG AGAAGAACC	3360
GTGGTAGAAG CGGCACGTAA GGCAATCTAT TCACCACTTC TTGAAACAAC TATTGACGGT	3420
GCTGAGGATG TTATCGTCAA CGTTACTGGT GGTCTTGACT TAACCTTGAT TGAGGCAGAA	3480
GAGGCTTAC AAATTGTGAA CCAGGCAGCA GGTCAAGGAG TGAACATCTG GCTCGGTACT	3540
TCAATTGATG AAAGTATGCG TGATGAAATT CGTGTAACAG TTGTTGCAAC GGGTGTTCGT	3600
CAAGACCGCG TAGAAAAGGT TGTGGCTCCA CAAGCTAGAT CTGCTACTAA CTACCGTGAG	3660
ACAGTGAAAC CAGCTCATTC ACATGGCTTT GATCGTCATT TTGATATGGC AGAAACAGTT	3720
GAATTGCCAA AACAAAATCC ACGTCGTTTG GAACCAACTC AGGCATCTGC TTTTGGTGAT	3780



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TGGGATCTTC	CCCGTGAATC	GATTGTTCTG	ACAACAGATT	CAGTCGTTTC	TCCAGTCGAG	3840
CGCTTTGAAG	CCCCAATTTT	ACAAGATGAA	GATGAATTGG	ATACACCTCC	ATTTTTCAAA	3900
AATCGTTAAG	TAAATGAATG	TAAAAGAAAA	TACAGAACTT	GTTTTTCGAG	AAGTTGCAGA	3960
GGCTAGTCTG	AGTGCTCATC	GAGAGAGTGG	TTCGGTCTCT	GTCATTGCAG	TTACCAAGTA	4020
TGTAGATGTA	CCGACAGCGG	AAGCCTTGCT	TCCGCTAGGT	GTCCATCATA	TCGGTAAAA	4080
TCCTGTAGAT	AAGTTTCTGG	AAAAATATGA	AGCTTTAAAA	GATCGAGATG	TGACTTGGCA	4140
TTTGATTGGT	ACCTTGCAAA	GACGTAAGGT	GAAAGATGTC	ATTCAATACG	TTGATTATTT	4200
CCATGCATTG	GACTCAGTAA	AGCTAGCAGG	GGAAATTCAA	AAAAGAAGTG	ACCGAGTCAT	4260
CAAGTGTTC	CTTCAAGTAA	ATATTCTTAA	AGAAGAAAGC	AAACACGGTT	TTTCGAGAGA	4320
GGAACTGCTG	GAAATCTTGC	CAGAGTTAGC	CAGACTAGAT	AAGATTGAAT	ATGTTGGTTT	4380
AATGACGATG	GCACCTTTTG	AGGCTAGCAG	TGAGCAGTTG	AAAGAGATTT	TCAAGGCGGC	4440
CCAAGATTTA	CAAAGAGAAA	TTCAAGAGAA	ACAAATTCCTA	AATATGCCTA	TGACCGAGTT	4500
AAGTATGGGA	ATGAGTCGTG	ATTATAAAGA	AGCGATTCAA	TTCCGTTCCA	CTTTGTTCG	4560
TATAGGTACA	TCATTTTTTA	AGTAGGAGAG	AACCATGTCT	TTAAAAGATA	GATTTCGATG	4620
ATTTATAGAT	TATTTTACGG	AGGATGAGGA	TTCAAGTCTC	CCTTATGAAA	AAAGAGATGA	4680
GCCTGTGTTT	ACTTCAGTAA	ATTCTTCACA	GGAACCGGCT	CTCCCAATGA	ATCAACCTTC	4740
ACAGTCGGCT	GGCACAAAAG	AGAACAATAT	CACCAGACTT	CATGCAAGAC	AACAGGAATT	4800
GGCAAATCAG	AGTCAGCGTG	CAACGGATAA	GGTCATTATA	GATGTTCTGT	ATCCTAGAAA	4860
ATATGAGGAT	GCAACAGAAA	TTGTTGATTT	ATTGGCAGGA	AACGAAAGTA	TCTTGATTGA	4920
TTTTTCAGTAT	ATGACAGAGG	TGCAGGCTCG	TCGTTGTTTG	GACTATTTGG	ATGGAGCTTG	4980
TCATGTTTTA	GCTGGAAATT	TGAAAAAGGT	AGCTTCTACC	ATGTATTTGT	TGACACCAGT	5040
GAACGTTATT	GTAATGTTG	AAGATATCCG	TTTACCAGAT	GAAGATCAAC	AGGGTGAGTT	5100
CGGTTTTGAT	ATGAAGCGAA	ATAGAGTACG	ATAATGATTT	TTTTAATTCG	TATGATTTAT	5160
AATGCAGTGG	ATATTTACTC	CCTGATTTTG	GTAGCCTTCG	CTGTCATGTC	TTGGTTTCCA	5220
GGTGCCTACG	AATCCAGTTT	AGGTCGTTGG	ATTGTAGCGT	TGGTGAAACC	AGTGCTTGCT	5280
CCCTTGCAAC	GCCTGCCTTT	ACAGATAGCG	GGTCTTGATT	TATCTGTTTG	GGTTGCGATT	5340
GTTTGGTTC	GATTTTTAGG	AGAAAACTTA	GTGCGTTTTC	TGGCGATGAT	AGGATGAATA	5400
AAGGGATTTA	TCAGCATTTT	TCCATAGAAG	ATCGTCCATT	TCTTGACAAG	GGAATGGAAT	5460
GGATAAAGAA	GGTAGAAGAT	AGCTATGCTC	CTTTTTTAAC	TCCTTTTATC	AATCCTCATC	5520

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AGGAGAAGCT ATTAAAGATT TTGGCCAAAA CCTATGGTCT TGCTTGTAGC AGTAGTGGGG	5580
AATTCGTCTC GAGTGAGTAT GTTCGAGTTT TATTATACCC AGATTATTTT CAACCAGAGT	5640
TTTCAGATTT TGAATATCT CTCCAGGAAA TTGTGTATTC CAATAAATTT GAACATTTAA	5700
CGCATGCTAA GATTTTAGGG ACAGTCATCA ATCAATTAGG GATTGAACGG AAACCTTTTG	5760
GAGATATCCT AGTAGATGAA GAACGGGCGC AGATTATGAT TAATCAGCAG TTTCTTCTTC	5820
TCTTTCAAGA TGGACTAAAG AAAATTGGTC GTATACCTGT TTCGCTGGAG GAACGTCCTT	5880
TCACCGAGAA AATAGATAAG CTAGAACAGT ATCGAGAAGT GGATTTATCT GTGTCTAGTT	5940
TTCGATTAGA TGTCTTTTA TCAAATGTTT TGAACTATC TAGGAATCAA GCAAACCACT	6000
TGATTGAAAA GAACTTGTC CAAGTAAATT ATCATGTGGT AGACAAATCA GATTACACTG	6060
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AGGGACAAAC GAAAAAGAG AAGAAAAAAA TAACCGTCCA GTTATTATTA AGTAAAGTGAG	6180
GAATAGAATG CCAATTACAT CATTAGAAAT AAAGGACAAG ACTTTTGGA CTCGATTCAG	6240
AGGTTTGGT CCAGAAGAAG TCGATGAATT TTTAGATATT GTGTTCTGTG ATTACGAAGA	6300
TCTTGTGCGT GCGAATCATG ATAAAAATTT GCGTATTAA AGTTTAGAAG AGCGTTTGTG	6360
TTACTTTGAT GAAATAAAG ATTCAATTGAG CCAGTCTGTA TTGATTGCTC AGGATACAGC	6420
TGAGAGAGTG AAACAGGCGG CGCATGAACG TTCAAACAAT ATCATTATC AAGCAGAGCA	6480
AGATGCGCAA CGCTTGTTGG AAGAAGCTAA ATATAAGGCA AACGAGATTC TTCGTCAAGC	6540
AACTGATAAT GCTAAGAAAG TCGCTGTTGA AACAGAAGAA TTGAAGAACA AGAGCCGTGT	6600
CTTCCACCAA CGTCTCAAAT CTACAATTGA GAGTCAGTTG GCTATTGTTG AATCTTCAGA	6660
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AGAAGTGGTT AGCGAAGTAC TTGGAGAACC GATTCCAGCT CCAATTGAAG AAGAACCAAT	6780
TGATATGACA CGTCAGTTCT CTCAAGCAGA AATGGCAGAA TTACAAGCTC GTATTGAGGT	6840
AGCCGATAAA GAATTGTCTG AATTTGAAGC TCAGATTAAA CAGGAAGTGG AAGCTCCAAC	6900
TCCTGTAGTG AGTCTCAAG TTGAAGAAGA GCCTCTGCTC ATCCAGTTGG CCCAATGTAT	6960
GAAGAACCAG AAGTAGCTCC AATGCATCCG ATAGGTCCAA CACCAGCTAC AGAAACTGTT	7020
GATTCAATAC CGGGATTGA AGCACCAGCA GAATCTGTTA CAATTTTATA AGAAATATTC	7080
TGAGAACAAT ATCTTATCCT TATATTCCA GCGAGCAGGA GATGGTGTGA GTCCTGTAAT	7140
CCCTATTGAT AAGATTATCC TCTCAAAAAC TCAAGTCTGA AGCTAGTAAG ATTTGACGTT	7200
TCCCACGTTA CGGATAAGA GGGAGAAAGA CTAATCTTTT TTCCGAATAA AGGTGGTACC	7260
ACGATTTTCG TCCTTTTGG AAGTCGTGGT TTTAATTTG TTATTATTTA TAAAGGAGAT	7320

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ACCATGAAAC TCAAAGACAC CCTTAATCTT GGGAAAACTG AATTCCCAAT GCGTGCAGGC	7380
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TCGATACGTA TCATAAACTT GTATTCCTCC TGTCTCTTAA TATACATTAA AAAAAAATT	21540
AAGTCAAGTT AATTTTGGAA AAAATTAAAA TAATAACTGA AAAATAGATT CTAAAGATAA	21600
CTTTCAGGAT AAATTTCTAA ATTATAAAC GCATAGTATC AAGTGTAATA AACTTGGAAT	21660
TATGCGTTTT ATCATGGAAA GATTTTTTAT AATAGCTAAA AAATAA	21706

(2) INFORMATION FOR SEQ ID NO: 37:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 6171 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 37:

GATCCCCAGG AAAAACCGAG GTTTTCCCAA TCAATCGTTA CTGTCATATT CCACTCCTTA	60
TTCTAAAAAC CTATTTCTTA TATTCTACAC TATTTTCTA AAATAGCAAG TATATTTTGT	120
AATTTTCAGA AAATTTCTCC AATAAAAACC AACTCTTAGA ACTGATTCTT CATTTCACTT	180
ATTTATCTTC AGTAACTACT TCCTGAAGAT AAGCGTCAAA AACTTCTTCA TCTGAAATCG	240
TGTCAGAAAT GAAGCTTCCA TTGCTAGTGC GTTCTGACAA GTTCAAGTCT TGCAATCGGC	300
TTTCATAGAT TGTTCCTTTA TTGGATTGGA CAAGCAGAGT TTGGTCGTTT ACATCCACTT	360
CCGTACTGAA GAAATCGCCA ACAATCCTT GCTCTGCAAC TGCTCCTGCC AAGAAGACAC	420
GATGCGGTTT GTTTTTC AACACGCAAGA CTTGTAATCC TCGTTTGGCA CGGCTGGTTG	480
CTAGAATTTC CTCAATGGAA ACACGTTTCA AGCTTCCACG CTGGGTCAAG AGGTAGAAGG	540
ACGAAGTATT ACAGATAAAG CCAGATTGGA GGACATCATC TTCTTTCAAA TTCATAGCCT	600
TGACACCTGC TGCCTTAGCA CCGACAACCG GAACCTCTTC GATATTGAAA CGCAGGGCAT	660
AACCATTTTG ACTAACCAAG ACAACATCAT CTAGTTTAAT CGGAGCCACT GCTACAATCT	720
GATCTGTATC GTCTTTGAGC TTAGCATACT TGACAGACTT AGATCTATAG GTCCGCCATG	780
GAGTGAATTG TTTTCGCTCT ACCCGTTTGA TTTGACCAAG GCGAGTCACT GCAAAGTAGG	840
TTGTGCGCATC GTCAAACGTA TCCAGTACTT CCACATAAAG GATTTCTTCA TTCGTTTCAA	900
AGTTTGTGAT GGTTTGGCTC AGATGCTCTC CGATGTCCTT CCAACGAATA TCTGCCAACT	960
CATGGATTGG TCTGTAGATG ACATTTCCAA GACTTGTGAA CATCAAGAGG TGCTGGGTTG	1020
TCTTGGCAGA TTGAACAAAA ATCAAACGGT CATCATCACG CTTGCCAATT TCTTCCAAGG	1080
TGGAAGCCGC AAAGGAACGT GGAAGGTAC GCTTGATGTA ACCTGCCTTG GTCACGCTGA	1140

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CGTAGGTATC TTCCTCAGCG ATAAGACTAG CTGTATCAAT CTCAATTGCT TTCGCAGTGT	1200
CTTCTAAAGA ACTCAAACGA GGAGTTGCAA ATTTCTTCTT GACCTCACGA AGTTCTTTCT	1260
TCATGAGATT GTACATAGTC CTTTCATCAC CGATAATAGC CGCCAGCATA GCAATCTTCT	1320
CACGAAGCTC TGCTTCTTCT TCCTGCAAGA CAACCATATC GGTATTGGTC AAACGGTACA	1380
GTTCGAAAGT TACGATAGCC TCAGCCTGTT CTTCCGTAAA ATCATAGCTA ACTTTGAGGT	1440
TTTCCTTGGC GTCCGCCTTA TTCTCAGAAG CACGGATAAG AGCAATGACT TCATCCAAAA	1500
TCGAAATCAC ACGAATCAAA CCTTCGACGA TATGGAGACG TTTCTCAGCC TTTTCTTTGT	1560
CAAAGCGTGA ACGCGCCAAA ATCACTTCTC GACGGTGAGC GATATAGCTA GACAGGATTG	1620
GAACAATCCC AACCTGACGA GGTGTGAAAT TGTCAATCGC CACCATATTA AAGTTGTAGT	1680
TGATTTGTAG GTCGGTGATC TTAATAAGT AGTTGAGAAC AAGCTCAGTA TTAGCGTCTT	1740
TCTTAAGTTC GATAGCGATA CGAAGACCAT CACGGTCAGA CTCATCACGA ACCTCAGCAA	1800
TCCCAGCTAC CTGTATTATTA ACACGAACAT CATCGATTTT CTTGACTAGA TTGGCCTTAT	1860
TGATTTTATA AGGAATCTCA ATAATAACGA TTTGTTCCCTT ACCACCTTTT AGCTTTTCAA	1920
TTTCAGTCTT GGAACGAACA ACCACGCGCC CTTTCCCAGT CTCATAAGCT TTCTTGATTT	1980
CATCACGACC CTGAATAATA GCCCCTGTAG GGAAGTCTGG TCCAGGCAAG AATTCATGA	2040
GTTTATCAAT CTTTGCAGTT GGGTGGTCAA TCATGTAAAC TGCAGCATCT ATGACCTCAG	2100
CTAAATTATG GGGAGGAATG TCTGTGGCAT AACCAGCCGA AATCCCAGTC GAACCATGTA	2160
CCAAGAGGTT TGGAAGGCT GCTGGCAAGA CCGTTGGTTC TTTCTCCGTA TCGTCAAAGT	2220
TCCATGCAAA AGGAATGTG TTTTCTCGA TATCCTGAAG AAGGTAGCCT GCAATTTTCA	2280
ACAAACGTGC CTCAGTATAA CGCATAGCCG CAGGAGGATC TCCGTCCATA GAACCGTTAT	2340
TACCGTGCAT TTCAACTAGA ATCTCACGAT TTTTCCAGTT CTGTGACATA CGAACCATGG	2400
CATCATAGAT AGAAGAATCC CCGTGTGGGT GGAAATTCCC CATGATGTTC CCGACTGACT	2460
TGGCCGACTT ACGGTAGTCT TTGTCAAAG TATTGCTATC CTTATTACATA GAATAAAGAA	2520
TACGGCGCTG AACCGGCTTC AACCCATCAC GAATATCTGG CAAAGCCCGG TCTTGAATAA	2580
TGTAATTGGA GTAGCGACCA AAGCGCTCTC CCATGATGTC CTCCAGGGAC ATGTTTGA	2640
TGTTAGACAT AAGATACAAA GCCCATAAAA TACCAAGTGA AAATAGAAAA TTCTTGAAGT	2700
AAGCAAATCT ACAAGAGAAAT TTATCTTTT CACACAGTAT CTAGGGCGTG TTCAACTCCT	2760
TTCAAAGAAT GTAGAGTAGG TTTTATGCA GTAAAAGATA TTTTACGGGA ATTCCTCCCG	2820
TGTTAGCTTA CGATAAGTAA CCAAATATC CTGTTTGTAT TTTTCAATAT GAAAATCTGG	2880
TTTTCAAAA TTAGTCTTAG TTTGTGCTT AGCCGCTCCC TTAAGCGCCT CTTTGAGATA	2940

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AGCACTCATA GCAGATTCTT CATTAATAAT CCTGCAATTT TTTCAAACCA AGATTTTCAA	3000
ACTGCTTTTT CACATAGTCA TTCACATCCG ACTCTAATTT CCAGTTTACT AACATATTAT	3060
TTTCTTTCAT TAAACACTG TCGTTTCTTC TAGCGTAAAC TTGACATTAT CTTCAATCCA	3120
TTTACGGCGT GGTTCACCT TATCTCCCAT GAGAACATTG ACGCGGCGTT CGGCGCGCGC	3180
TAAATCTTCA ATTGTGACAC GGATGAGGGT ACGTGTTTCT GGGTTCATGG TTGTTTCCCA	3240
GAGCTGGTCC GCATTCATCT CACCAAGTCC TTGTATCGT TGGAGGGTAG CGCCTTTACC	3300
GAAGTGTTA CGGAGTTCTT CTAGTTCTCC GTCCGTCCAA GCGTAGGCCA CTTCTTCTTT	3360
CTTGCCTTTA CCTTTGGACA TCTTGTAAG AGGTGGGAGG GCAATATAGA CATGACCTGC	3420
CTCGACTAGC GGACGCATGT AACGGTAGAA AAATGTCAAG AGCAAGGTCT GGATATGGGC	3480
ACCGTCGGTA TCCGCATCGG TCATGATAAT GATCTTATCA TAGTTGGCAT CTTCAATAGA	3540
GAAGTCTGCT CCAACACCCG CACCAATGGT ATAAATCATG GTATTGATCT CTTCATTTTT	3600
GAGGATATCC GCCATCTTGG CCTTGGCTGT ATTGACAACC TTACCACGAA GAGGTAGAAT	3660
AGCCTGGAAC TTGCGGTAC GACCTTGTTT GGCAGAACCA CCGGCAGAGT CCCCCTCAAC	3720
TAGATAGAGT TCATTCCTAG CAGGATTCTT AGATTGGGCT GGGGTCAATT TCCCAGACAA	3780
CAAGCCCTTA TCTTCTTGT TTTTCTTCCC ATTTGCGCTC TCATCACGCG CCTTACGTGC	3840
TGCTTCACGA GCATCACGGG CCTTGATAGC CTTGCGGATG AGGTTAGAAG CTAATTCCCC	3900
ATTTTCCATA AGGAAAAAGG TCAACTTATC AGCCACTATT CCATCCACAA CTGGGCGAGC	3960
TAGGGGGCTT CCTAGTTTAT CCTTGGTCTG TCCTTCAAAC TGCAAGTGTT CTTCAGGAAC	4020
TAAGATAGAA AGAACGGCCG CTAGTCCCTC ACGATAGTCT GAACCTTCAA GGTTTTTATC	4080
TTTTTCCTTG AGAAGACCTG TTTTACGTGC ATAGTCATTC ATGACCTTGG TAATGGCAGA	4140
CTTGAGTCCT GTCTCGTGCG TTCCACCGTC CTTGGTGCGA ACGTTATTGA CAAAAGATAG	4200
AATGTTATCT GAGAATCCGT CATGTACTG GAGGGCTACT TCCACTTGAA AACCATTGTC	4260
TTCCCTTCA AAGTAAAGAA CTGGCGTCAA GATTTCCTTA TCTTCGTTGA GATAAGAAAC	4320
AAAACTTGT ACTCCATTCT CATAGTGGAA CTCAATCGCT TCATTTGTTT GCTTGTCCTT	4380
TAAAGACAAG GTCACATTTT TCAAGAGAAA GGCTGATTCA TTAAGGCGCT CTGAAATGGT	4440
ATTGTACTTG AAATCTGTCG TAGAAAATAT AGTCGCGTCA GGCATAAAAG TAACTTTGGT	4500
GCCTGTTTTA GACTTGGGTG CTGTACCGAT TTTCTTCAAA GTCGTGACAG GTTTTCCACC	4560
ATTTTCGAAA CGTTGCTTGT AAATGCGCC ATCAGGGTA ATTTCAACTT CTAACCAGCT	4620
AGAAAGGGCG TTAACAACGG AAGAACCAC TCCGTGAAGT CCACCTGATG TCTTATAGCC	4680

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ACCTTGACCG AATTTCCCTC CGGCATGAAG AATGGTAAAG ATAACCTCAA CAGTTGGAAT	4740
TCCCATAGCG TGCATACcTG TCGGCATCCC ACGTCCATGG TCTTGAACCG TTAGACTACC	4800
GTCTTTATTG ATAGTTACAT CAATACGATC ACCAAACCCA GACAAGGCTT CATCGACTGC	4860
ATTATCAACG AMTTCCCAA CTAGGTGATG AAGACCAGCG CCATCGGTCG ATCCAATATA	4920
CATCCCTGGA CGTTTTCGGA CCGCATCCAA CCCTTCTAGC ACCTGAATAG CATCATCATT	4980
ATAATTGTTA ATATTGATTT CCTTTTGTGA CACAAGGAAC CTCCTATTCTG TTCATCTTTA	5040
CTATTCTACA GGTTTTCCAA GGATTTTGCA AAATTTTCTT TTCTCCGATG TGACAATTTT	5100
AGCAGAGATT CTCTGCTTTT CTTTCCCAAT TCATGATATA ATAGGAGTAT GATTACAATA	5160
GTTTTATTAA TCCTAGCCTA TCTGCTGGGT TCGATTCCAT CTGGTCTCTG GATTGGACAA	5220
GTATTCTTTC AAATCAATCT ACGCGAGCAT GGTTCGTGTA ACACTGGAAC GACCAACACC	5280
TTCCGCATTT TAGGTAAGAA AGCTGGTATG GCAACCTTTG TGATTGACTT TTTCAAAGGA	5340
ACCCTAGCAA CGCTGCTTCC GATTATTTTT CATCTACAAG GCGTTTCTCC TCTCATCTTT	5400
GGACTTTTGG CTGTTATCGG CCATACCTTC CCTATCTTTG CAGGATTTAA AGGTGGTAAAG	5460
GCTGTCGCAA CCAGTGCTGG AGTGATTTTC GGATTGCGC CTATCTTCTG TCTCTACCTT	5520
GCGATTATCT TCTTTGGAGC TCTCTATCTT GGCAGTATGA TTTCACTGTC TAGTGTCACA	5580
GCATCGATTG CGGCTGTTAT CGGGGTCTG CTCTTTCCAC TTTTGGTTT TATCCTGAGT	5640
AACTATGACT CTCTCTTCAT CGCTATTATC TTAGCACTTG CTAGTTTGAT TATCATTCGT	5700
CATAAGGACA ATATAGCTCG TATCAAAAAT AAAACTGAAA ATTTGGTCCC TTGGGGATTG	5760
AACCTAACCC ATCAAGATCC TAAAAAATAA AATGCCAGTT CTGTACTGCC CCCAACAGT	5820
TAGACAAATA ATTTATCCAA AGGATTTAGT TCTGTACTGC ACAGGACTAA GTCCTTTTAG	5880
TTTACCTTA ATTCGTTTGT TGTGTAGTA ATCAATATAG TCTATAATGG CTGTGTTCAA	5940
TTGATTAAAGT GATTTAAATG TTTTCTCATA GCCATAAAC ATTTCGGATT TTAATAATGCC	6000
AAAGAAAGAT TCCATCCTAC CGTTGTCTTG GCTGTTGCCC TTACGTGACA TGGATGCTTG	6060
AATTCCCTTA CTCTCTAGGA ACCGATGATA AGAATCGTGT TGGTATTGCC AGCCTTGGTC	6120
ACTATGGAGA ATCGTATTCT CGTAGTGCTT CTCTGTGAAT GCCTGTTCCA A	6171

(2) INFORMATION FOR SEQ ID NO: 38:

- (i) SEQUENCE CHARACTERISTICS:
  - (A) LENGTH: 18475 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

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(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 38:

TATTACAAAT AAAAAACGG AGGAGTGCTT TATGAAAGCC TATACTTATG TTAAACCAGG	60
ACTTGCTTCT TTTGTTGATG TAGACAAACC AGTTATTTCG AAGCCAACAG ACGCTATTGT	120
CGGTATTGTA AAAACCACTA TTTGTGGAAC AGACCTCCAT ATTATCAAAG GGGATGTTCC	180
TACTTGCCAA AGTGGTACCA TTCTTGCCCA CGAAGGGATT GGGATTGTTG AAGAAGTTGG	240
GGAAGGAGTT TCCAACCTCA AAAAAGGTGA CAAGGCTTG ATTTCTTTCG TCTGTGCCTG	300
TGGTAAATGC TACTACTGTA AAAAAGGAAT TTATGCTCAC TGTGAAGACG AAGGGGGCTG	360
GATTTTCGGT CACTTGATTG ATGGTATGCA GGCTGAATAT CTACGTGTCC CTCATGCAGA	420
TAATACTCTT TACCATACTC CAGAAGACTT GTCAGATGAA GCTTTGGTTA TGCTGTCAGA	480
CATTCTGCCT ACTGGATATG AAATTGGTGT CTTAAAAGGG AAAGTAGAAC CTGGTTGCAG	540
CGTAGCCATT ATTGTTTCAG GTCCAGTTGG ATTGCGTGCT CTTTAAACAG CCCAATTCTA	600
TTCAACAGCT AAATTGATTA TGGTAGACCT AGACGATAAC CGCTTGAAA CTGCCCTATC	660
ATTCGGTGCG ACTCATAAGG TTAATTCTTC AGACCCTGAA AAAGCCATTA AAGAAATTTA	720
TGATTTGACA GATGGTCGTG GTGTGGATGT CGCTATCGAA GCTGTTGGTA TTCTGCAAC	780
ATTTGATTTT TGTCAAAAGA TTATCGGTGT AGACGGAACG GTTGCCAACT GTGGTGTGCA	840
TGGTAAACCA GTTGAATTCG ATTTAGATAA ACTTTGGATT CGCAACATCA ATGTAACAAC	900
TGGTTTGGTA TCTACAAATA CGACTCCACA ATTTGTGAAA GCACTTGAAA GTCATAAGAT	960
TGAACCGGAA AAATTGGTAA CTCACTATTT CAAACTCAGT GAAATTGAAA AAGCCTACGA	1020
AGTCTTCAGT AAGGCAGCAG ACCACCATGC CATTAAAGTC ATTATCGAAA ACGATATCTC	1080
AGAAGCCTAA GTAGTAAAAA TATTTTGTGA CATAAGTAAA TAGAAATTCA GTCATCCATC	1140
AGATGGCTGG ATTTTATATC AAAAAATTAA GAAATGAGCA TATTTCTTTC CTTGTCTGGC	1200
GGAATTGGTT ATAATATACG GTACAAAGGA ATGAATGAAT ATGTATCGTG TTATAGAAAT	1260
GTACGGAGAT TTTGAACCGT GGTGGTTCTT AGAAGTTGG GAAGAAGATA TTGTAGCAAG	1320
TAGAAAATTT GACCAGTATT ATGATGCTCT CAAATACTAC AAAACTTGCT GGTTTAGATT	1380
GGAACAAGAA TCGCCTCTTT ATAAAAGTAG AAGCGACTTG ATGACCAATT TTTGGGACCC	1440
GGAAGACCAA CGCTGGTGTG ATGAATGTGA TGAGTATTTA CAACAATACC ATTCTTTGGC	1500
TCTTTTGCAG GATGAGCAGG TTATCCCAGA CGAAAACTA CGCTCAGGCT ATGAAAAACA	1560
AACCAATCAG GAAAGGAATC GTTCTTGCCG TATGAAATTA AAATAGAGAA AAGTAACTTT	1620
TTTGGAGTTG CTTTTTTTAT TTTTCTAACT CTTTGCGAAT AGTATAGGTG ACGAGGTAAG	1680

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TATGGTTCAA GAAATTGCAC AAGAAATCAT TCGTTCAGCT CGGAAAAAAG GGACGCAGGA	1740
TATCTATTTT GTCCTAAGT TAGACGCTA TGAGCTTCAT ATGAGGGTAG GAGACGAGCG	1800
CTGTAAAAAT GGTAGCTATG ATTTTGAAAA GTTTGCAGCC GTTATCAGTC ACTTTAAGTT	1860
TGTGGCGGGT ATGAATGTGG GAGAAAAAAG ACGTAGTCAA CTGGGTTCCCT GTGATTATGC	1920
CTATGACCAT AAGATAGCGT CTCTACGTTT ATCTACTGTA GCGGATTATC GGGGGCATGA	1980
GAGTTTGTTT ATCCGTTTGT TGCACGATGA GGAGCAGGAC CTGCATTTTT GTTTTCAGGA	2040
TATTGAAGAA TTAGGCAAGC AGTACAGGCA ACGGGGACTC TATCTTTTTG CTGGTCCGGT	2100
TGGGAGTGGT AAGACGACCT TGATGCATGA ATTGTCCAAG TCACTCTTTA AAGGACAGCA	2160
AGTTATGTCC ATCGAAGATC CTGTCGAAAT CAAGCAGGAC GACATGCTTC AGTTGCAGTT	2220
GAACGAAGCA ATCGGCCTAA CCTATGAAAA TCTAATCAAA CTTTCCTTGC GTCATCGACC	2280
AGATCTCTTG ATTATCGGAG AAATTCGTGA CAGCGAGACG GCGCGTGCAG TGCTCAGAGC	2340
TAGTTTGACA GGTGCGACAG TCTTTTCAAC CATTACGCCC AAGAGTATCC GAGGTGTTTA	2400
TGAGCGTCTG CTGGAGTTGG GTGTGAGTGA AGAAGAATTG GCAGTTGTTT TGCAAGGAGT	2460
CTGCTACCAG AGATTAATCG GGGGAGGAGG AATCGTTGAC TTGCAAGCA GAGATTATCA	2520
AGAACACCAA GCAGCCAAGT GGAATGAGCA AATTGACCAG CTTCTTAAAG ATGGACATAT	2580
CACAAGTCTT CAGGCTGAGA CGGAAAAAAT TAGCTACAGC TAAGCAAAAA AATATCATCA	2640
CCCTATTTAA CAATCTCTTT TCTAGCGGTT TTCATCTGGT GGAGACTATC TCCTTTTATG	2700
ATAGGAGTGC TTTGTTGGAC AAGCAGTGTG TGACCCAGAT GCGTGTGGGC TTGTCTCAGG	2760
GGAAATCATT CTCAGAAATG ATGGAAAGTT TGGGATGTTT AAGTGCTATT GTCACCTAGT	2820
TATCCCTAGC TGAAGTTCAT GGCAATCTCC ACCTGAGTTT GGGAAAGATA GAAGAATATC	2880
TGGACAATCT GGCTAAGGTC AAGAAAAAAT TGATTGAAGT AGCGACCTAT CCCTTGATTT	2940
TGCTGGGTTT TCTTCTCTTA ATTATGCTGG GGCTACGGAA TTACCTGCTC CCACAACTGG	3000
ATAGTAGCAA TATTGCCACC CAAATTATCG GTAATCTGCC CCAAATTTTT CTAGGCATGG	3060
TAGGGCTTGT TTCCGTGCTT GCCCTTTTAG CACTCACTTT TTATAAAAGA AGTTCTAAGA	3120
TGAGTGTCTT TTCTATCTTA GCACGCCTTC CTTTATTGG AATCTTTGTG CAGACCTACT	3180
TGACAGCCTA TTATGCACGT GAATGGGGGA ATATGATTTT ACAGGGAATG GAGTTGACGC	3240
AGATTTTCA AATGATGCAG GAACAAGGTT CCCAGCTCTT TAAAGAAGTC GGTCAAGATC	3300
TGGCTCAAAC CCTGAAAAAT GGCCGTGAAT TTTCTCAGAC GATAGGAACC TATCCITTCT	3360
TTAGGAAGGA ATTGAGTCTC ATCATAGAGT ATGGGGAGT TAAGTCCAAG CTGGGTAGTG	3420
AGTTGGAAT CTATGCTGAA AAAACTTGGG AAGCCTTTTT TACCCGAGTC AACCGCACCA	3480



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TGAATTGGT GCAGCCACTG GTTTTATCT TTGTGGCACT GATTATCGTT TTACTTTATG	3540
CGGCAATGCT CATGCCCATG TATCAAAATA TGGAGGTAAA TTTTAAAAAT GAAAAAATG	3600
ATGACATTCT TGA AAAAAGC TAAGGTAAA GCTTTTACAT TGGTGGAGAT GTTGGTGGTC	3660
TTGCTGATTA TCAGCGTGCT TTTCTTGCTC TTGTACCTA ATCTGACCAA GCAAAAAGAA	3720
GCAGTCAATG ACAAAGGAAA AGCAGCTGTT GTTAAGGTGG TGGAAAGCCA GGCAGAACTT	3780
TATAGCTTAG AAAAGAATGA AGATGCTAGC CTAAGAAAGT TACAAGCAGA TGGACGCATC	3840
ACGGAAGAAC AGGCTAAAGC TTATAAAGAA TACAATGATA AAAATGGAGG AGCAAATCGT	3900
AAAGTCAATG ATTAAGGCCT TTACCATGCT GGAAAGTCTC TTGGTTTTGG GACTTGTGAG	3960
TATCCTTGCC TTGGGCTTGT CCGGCTCTGT CCAGTCCACT TTTTCAGCGG TAGAGGAACA	4020
GATTTTCTTT ATGGAGTTTG AAGAACTCTA TCGGGAACC CAAAAACGCA GTGTAGCCAG	4080
TCAGCAAAAG ACTAGTCTGA ACTTAGATGG GCAGACGCTT AGCAATGGCA GTCAAAAGTT	4140
GCCAGTCCCT AAAGGAATTC AGGCCCCATC AGGCCAAAGT ATTACATTTG ACCGAGCTGG	4200
GGGCAATTCTG TCCCTGGCTA AGGTGAATT TCAGACCACT AAAGGAGCGA TTCGCTATCA	4260
ATTATATCTA GGAATGGAA AAATTAAACG CATTAAGGAA ACAAAAAATT AGGGCAGTGA	4320
TTTTACTGGA AGCAGTAGTC GCTCTAGCTA TCTTTGCCAG CATTGCGACC CTCCTTTTGG	4380
GACAAATTCA AAAAAATAGG CAAGAGGAAG CAAAAATCTT GCAAAAGGAA GAAGTCTTGA	4440
GGGTAGCTAA GATGCCCTG CAGACGGGC AAAATCAGGT AAGCATCAAC GGAGTTGAGA	4500
TTCAGGTATT TTCTAGTGAA AAAGGATTGG AGGTCTACCA TGGTTCAGAA CAGTTGTTGG	4560
CAATCAAAGA GCCATAAGGT CAAGGCTTTT ACCTTGTTAG AATCCCTGCT TGCCCTCATT	4620
GTCATCAGTG GGGGATTACT CCTTTTCAA GCTATGAGTC AGCTCCTCAT TTCAGAAGTT	4680
CGCTACCAGC AACAAAGCGA GCAAAAGGAG TGGCTCTTGT TTGTGGACCA ACTTGAGGTA	4740
GAATTAGACC GTTCGCAGTT CGAAAAAGTA GAAGGCAATC GCCTATACAT GAAGCAAGAT	4800
GGCAAGGACA TCGCCATCGG TAAGTCAAAG TCAGATGATT TCCGTAAAAC GAATGCTCGT	4860
GGTCGAGGTT ATCAGCCTAT GGTTTATGGA CTCAAATCTG TACGGATTAC AGAGGACAAT	4920
CAACTGGTTC GCTTTCATT CCAGTTCCAA AAAGGCTTAG AAAGGGAGTT CATCTATCGT	4980
GTGGA AAAAG AAAAAGTTA AGGCAGGTGT TCTCCTCTAC GCAGTACCA TAGCAGCCAT	5040
CTTTAGTCTT TTGTTGCAAT TTTATTTGAA CCGACAAGTC GCCCACTATC AAGACTATGC	5100
TTTGAATAAA GAAAAATTGG TTGCTTTTGC TATGGCTAAA CGAACCAAAG ATAAGGTTGA	5160
GCAAGAAAGT GGGGAACAGT TTTTAAATCT AGGTGAGTA AGCTATCAA ACAAGAAAC	5220

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TGGCTTAGTG ACGAGGGTTC GTACGGATAA GAGCCAATAT GAGTTTCTGT TTCCTTCAGT	5280
CAAAATCAAA GAAGAGAAAA GAGATAAAAA GGAAGAGGTA GCGACCGATT CAAGCGAAAA	5340
AGTGGAGAAG AAAAAATCAG AAGAGAAGCC TGAAAAGAAA GAGAATTCAT AGTCAATTCA	5400
ACTATAATGC GTTGAATCCA GAATAGTCCA CTGTAGTTTC TAGAAAATTG CTGGAAATGG	5460
ATGTTAAGCT CCAATTCATT TGTATTATATC TTATTTTCAGT TTACTATACT TTGTGCTAAA	5520
TTAAAGATAT GAAACATGAT TTTAACCACA AAGCAGAAAC TTTCGATTCC CCTAAAAATA	5580
TCTTCCTCGC AAACCTGGTA TGTCAAGCAG CCGAGAAACA GATTGATCTT CTATCAGACA	5640
AAGAAATTTT AGATTTTCGGT GGTGGCACGG GTCTATTAGC CTGCCCCCTA ACCCCTAGCC	5700
AAGCAGGCTA AGTCAGTCAC TCTTGTAGAC ATTTCTGAGA AAATGTTGGA GCAAGCTCGT	5760
TTGAAAGTGG AGCAGCAAGC AATCAAGAAT ATCCAGTTTT TGGAGCAAGA TTTACCGAAA	5820
AATCCCTTGG AGAAAGAGTT TGATTGCCTT GCTGTTAGTC GGGTTCTTCA TCATATGCCT	5880
GATTTGGATG CGGCTCTCTC ACTGTTTCAT CAACATTGA AGGAAGATGG GAAACTCATC	5940
ATTGCTGATT TTACCAAGAC AGAAGCTAAT CATCATGGAT TTGATTTAGC TGAACCTGAA	6000
AACAAGCTAA TTGAGCATGG TTTTTCATCT GTGCATAGTC AGATTCTCTA TAGTGCTGAA	6060
GACCTGTTTC AAGGAAATCA CTCAGAATTC TTTTAAATAG TAGCCCCAAA ATCACTCGCC	6120
TAGTCAGGGA GTGATTTTTC TATAAGGATG GAAAAAGAA GGGAAATTTG GTAAGATAGG	6180
AATATGGATT TTGAAAAAAT TGAACAAGCT TATACCTATT TACTAGAGAA TGTCCAAGTC	6240
ATCCAAAGTG ATTTGGCGAC CAACTTTTAT GACGCCTTGG TGGAGCAAAA TAGCATCTAT	6300
CTGGATGGTG AAACCTGAGCT AAACCGAGTC AAGGAGAACA ATCAAACCCT TAAGCGTTTA	6360
GCACTACGCA AAGAAGAATG GCTCAAGACC TACCAGTTTC TCTTGATGAA GGCTGGGCAA	6420
ACAGAACCCT TGCAGGCCAA TCACCAGTTT ACACCGGATG CTATTGCTTT GCTTTTGGTG	6480
TTTATTGTGG AAGAGTTGTT TAAAGAGGAG GAAATTACTA TCCTCGAAAT GGGTCTGCGG	6540
ATGGGAATTC TAGGCGCTAT TTTCTTGACC TCGCTTACTA AAAAGGTGGA TTACTTGCGA	6600
ATGGAAGTGG ATGATTGCTT GATTGATCTG GCAGCTAGCA TGGCAGATGT AATTGGTTTG	6660
CAGGCTGGCT TTGTCCAAGG AGATGCCGTT CGCCCAAAA TGCTCAAAGA AAGCGATGTG	6720
GTCAATCAGT ACTTGCCTGT CGGCTATTAT CCTGATGATG CCGTTGCGTC GCGCCATCAA	6780
GTGCTTCTA GCCAAGAACA TACTTACGCC CATCACTTGC TCATGGAACA AGGGCTTAAG	6840
TACCTCAAGT CAGACGGATA CGCTATTTTT CTAGCTCCGA GTGATTTGTT GACCAGTCCT	6900
CAAAGTGATT TGTAAAAAGA ATGGCTGAAA GAAGAGGCGA GTCTGGTTGC TATGATTAGT	6960
CTGCCTGAAA ATCTCTTTGC TAATGCCAAA CAATCTAAGA CTATTTTAT CTACAGAAG	7020

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AAAAATGAAA TAGCAGTAGA GCCTTTTGTT TATCCACTTG CTAGCTTGCA AGATGCAAGT	7080
GTTTTAATGA AATTTAAAGA AAATTTTCAA AAATGGACTC AAGGTACTGA AATATAAAAT	7140
AGATTTTGTT ATAATAGTTG AAAACGCTTA AAAAGGGGTA TCATGTTATG ACAAAAACAA	7200
TTGCAATCAA TGCAGGAAGT TCAAGTTTGA AATGGCAATT ATACTTAATG CCAGAAGAAA	7260
AAGTATTGGC GAAAGGTTG ATTGAACGTA TCGGTTTGAA AGATTCAATT TCAACTGTAA	7320
AATTTGACGG CCGTTCTGAA CAACAAATTT TGGATATTGA AAATCATATA CAAGCCGTTA	7380
AAATTTTATT GGATGACTTG ATTCGTTTCG ATATTATCAA GGCTTATGAC GAGATTACAG	7440
GTGTGGACA TCGTGTGTT GCTGGTGGAG AATATTTCAA AGAATCAACA GTTGTGAGG	7500
GAGATGTTT AGAAAAAGTT GAAGAGTTGA GTTTGTTGGC TCCTCTACAC AACCCGGCCA	7560
ATGCAGCAGG TGTTCTGTC TTCAAGGAAT TGTGCCAGA CATTACCAGT GTAGTTGTTT	7620
TTGATACTTC CTTCCACACA AGTATGCCAG AGAAAGCTTA TCGCTACCCT CTACCAACAA	7680
AATATTACAC AGAAAAACAAG GTTCGTAAAT ACGGTGCTCA TGGTACAAGT CACCAGTTTG	7740
TAGCAGGAGA AGCTGCAAAA CTCTTGGGAC GTCCATTAGA AGACTTGAAG TTAATTACCT	7800
GTCATATTGG TAACGAGGC TCAATTACAG CTGTGAAAGC CGGCAAATCT GTAGACACTT	7860
CTATGGGGTT CACTCTCTT GGTGGTATTA TGATGGGAAC GCGTACAGGG GATATTGATC	7920
CAGCTATCAT TCCTTATTTA ATGCAATATA CAGAGGATTT TAACACACCA GAAGATATCA	7980
GTGCTGTTCT TAACCGTGAA TCAGGTCITT TGGGAGTTT TGCTAATTCT AGCGATATGC	8040
GCGATATAGA AGCAGCTGTA GCAGAAGGGA ATCAGGAGC TAGCTTGGCT TATGAAATGT	8100
ATGTTGACCG TATCCAAAA CATATCGGTC AGTACCTTGC AGTGCTAAAT GGAGCAGATG	8160
CCATTGTTT CACAGCAGT GTCGGTGAAA ATGCAGAGAG TTCCGTCGT GATGTAATCT	8220
CAGGGATTTG GTGGTTTGGT TGTGATGTTG ATGATGAAAA GAATGCTCTT GCGTTACAG	8280
GAGACATCTC AACAGAGGCA GCTAAAATCC GTGTCTTGGT TATTCCAACA GATGAAGAAT	8340
TAGTCATTGC CCGTGACGTT GAACGCTTGA AAAATAAGT GAAACTAAAA AAATATTCAA	8400
TACAAGGAGT TGGGAAAGTT ATTTTCCAG CTCTTTTTC TGATGAAATT GTCCAAAAC	8460
TTGCTATGAT TGGCTTTT GAAAAATATG GTATAATAGT AGTAATTTAA TAGATGGAGT	8520
TGAGTTTGA AGAAAACTT TCGTGAAAA AGAGAGAAAG ATTTTAAGGC GATTTTCAAG	8580
GAGGGGACAA GTTTTGCTAA TCGCAAATTT GTGGTCTACC AATTAGAAAA CCAGAAAAAC	8640
CGTTTTCGAG TAGTCTATC AGTTAGCAAA AAATGGGGA ATGCCGTCAC TAGAAATCAA	8700
ATTAAGCGAC GGATTCGGCA TATTATCCAG AATGCAAAAG GGAGTCTGGT AGAAGATGTC	8760

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AATCTACTCC ATGTATTAAA ATTATCAAAG ATTTACCGGG AAGGAAATGG GAGTGAAAAA	8880
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TCTCTTTACG GTCTTGATTC GTACAGTCCT CTTGCCAGTC TTTCAGGTGC AAATGGTGGC	9120
TTCTAGGAAA ATGCAGGAAG CTCAGCCACG CATTAAGGCG CTTGAGAAC AATATCCAGG	9180
TCGAGATATG GAAAGCAGAA CCAAACTAGA GCAGGAAATG CGTAAAGTAT TTAAAGAAAT	9240
GGGTGTCAGA CAGTCAGACT CTCTTTGGCC GATTTTGATT CAGATGCCGG TTATTTTGGC	9300
CCTGTTCCAA GCCCTATCAA GAGTTGACTT TTAAAGACA GGTCAATTTCT TATGGATTAA	9360
CCTTGAGTAG GTGGATACAA CCCTTGTCT TCCGATTTTA GCAGCAGTAT TCACCTTTTT	9420
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TCCAAGAATG AAGGCTCATA TCAAAGTCAT TTCTAGGGAG AAAAAAGGCT TTCTTGGTCT	9840
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TGAAAGTCAA GAACTAGAAG ACTTGGGCTT GAAAGTTGAA ACGAACTTTG ATATTGAACA	10260
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CGAACACCGT GCAGAAGTCT TGCAGACCTA TGCGCAAAAA TTGGCGACTC GTGTTTTGGA	10560

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CGTAATCCTG ATAAAGCGGG AGCAGAGCGA GAGAAGATGC TGGCATTTCCG CCACAAAGGA	10860
CAAGAGGCCC GAAAGGTTTT TACAGAACTG GCCAAAGCCT TTCAAGCAAG CCATCCAGAA	10920
TGGCAACTCC AACAGACTAG CCAGTGGATG AATCAGGCCC AGCGTTTGAG ACCACATTTT	10980
TGGGTTTATC TACAGAGAGA CGGACAAGTG ACAGAACCTA TGATGGCCTT ACGTTTGTAT	11040
GGGACATCTA CTGACTTTGG AATTTCTTTG GAAGTCAGTT TCATCGAACG TAAGAAGGAT	11100
GAGCAAACAC TGGGCAAGCA GGCCAAAGTT TTAGACATTC CAACCGTTAA AGGGATTTAT	11160
TATCTAACCT ACTCTAATGG TCAAAGTCAA CGGTGGGAGG CGAATGAAGA AAAGCGTCGT	11220
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AAAATTCTTC CCTATTATCT AGCTACGAGA AAATAAGATA ATTTGTAAAA CATCATAAAT	11400
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GCATTATATA ATAACTTAC AAAACAATT CAAAAGGAGA ACAATTATGG AAGTCGTTTC	11520
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ATTGGTGTTG ATAGGATATG CACTTTTGAA AAAACCTGCC CATGACGTTT TTTCAGGGTT	11640
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CTTTCGTCCA ATCTTAGCAG CTCTTAACTA CAAATTCCAA ATTGGTGCAG CGGTTATCGA	11760
CCCTTACTTT GGACTTGCTG CAGCAAACAA CAAAATTGTA GCAGAGTTTC CAGATTTTGT	11820
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TCGAAAGATT ACGAAGGTAA GAACCCTCTT TATTACTGGT CACATCATGG TACAACAAGC	11940
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GATGCTCGTA TTCTTCGGAG CCATTCTTTT AATCTTGGGT CCAGACATTA TGTCTAATAA	12300

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AGAAGTCATC	ACTTCAGGAA	CTCTATTCAA	TCCTGCTAAA	CAAGATTTCT	TTATGTACAT	12360
TATCCAAACA	GCCTTTACCT	TCTCAGTTTA	CTTGTTTCGT	TTGATGCAAG	GTGTCCGAAT	12420
GTTCGTATCT	GAGTTGACAA	ACGCCTTCCA	AGGTATTTC	AACAAATGT	TGCCAGGTTC	12480
ATTCACGCG	GTGACGTTG	CAGCTTCCTA	TGGATTTGGT	TCTCCAAATG	CTGTCTTGTC	12540
AGGATTTACC	TTTGGTTTGA	TTGGTCAATT	GATTACAATT	GTTTGTCTCA	TCGTCTTTAA	12600
AAATCCGATT	CTTATTATTA	CAGGATTTGT	ACCAGTGTTC	TTTGACAATG	CAGCCATGTC	12660
GGTCTACGCT	GATAAACGCG	GCGGATGGAA	AGCGGCTGTT	ATCCTTTCCT	TTATATCAGG	12720
TGTCCTTCAA	GTGCTCTAG	GAGCTCTTTG	TGTGGCCCTT	CTCGATTGG	CATCTTATGG	12780
TGGCTACCAT	GGAAATATCG	ACTTTGAATT	CCCATGGCTT	GGATTGGAT	ATATCTTCAA	12840
ATACCTTGGT	ATTGTTGGTT	ATGTACTTGT	GTGTCTCTTC	TTGCTTGTTA	TTCCCTCAACT	12900
TCAATTTGCC	AAAGCAAAG	ATAAAGAGAA	ATATTACAAC	GGTGAAGTTC	AAGAAGAAGC	12960
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TGGGTTTCATC	AATGGTTATC	AAGATGAAGG	TTGAAAATGC	TCTCCGTAAG	CTTAATCAAA	13080
CAGATTTTAC	AGTCAATTCA	TGCAGTGTCTG	GTGAAGCTAA	AGGTTAGCA	GTAGGATATG	13140
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TAATTGGGCT	TGATAACTTG	ATGGATGATA	AAGAAATCAC	CGAAAACTC	AGTCAAGCAC	13260
TACAGTAAAA	GGTTGGAGGG	GGCTGGACAG	AAACTGAGAG	TTATCGTTTC	TGTCCTTCTC	13320
CCTCTTTAAA	TAAAGGAGGC	AGATATGAAT	TTAAAACAAG	CTTTAATTGA	CAATGACTCG	13380
ATCCGACTAG	GTTTAGAGGC	TAACAATTGG	AAAGAAGCAG	TCAAGGTAGC	AGTAGATCCC	13440
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AGTGTAGCCA	TTCCACAAAT	TATTGCCCTA	TTTGAATTAG	AAGATTCTAT	TGCACGTTTA	13740
CAGGCTTGCC	AGACTAAAGA	AGATGTCTTG	GCTATGATTG	AAGAATCTAA	GGATAGCCCT	13800
TATCTCGAAG	GATTGGATTT	GGAAAGTTAG	AAAGAGGAAT	AAAGAAATGA	CAAAAAGAAT	13860
ACCTAATTTA	CAAGTTGCAT	TAGACCATTTC	AGACTTGCAA	GGAGCGATTA	AAGCAGCTGT	13920
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AAGTGAACGTG	GCTGAAGTCT	TGCGTAGCCT	TTTCCCAGAT	AAGATTATTG	TGGCAGACAC	14040
AAAATGTGCT	GATGCTGGTG	GAACAGTTGC	TAAAAATAAT	GCGGTTTCGTG	GAGCAGACTG	14100

GATGACTTGT ATCTGTTGTG CAACCATCCC TACTATGGAA GCAGCTCTAA AGGCTATCAA	14160
GACTGAACGA GGAGAACGAG GCGAAATCCA GATCGAGCTT TATGGCGATT GGACTTTTGA	14220
ACAAGCTCAG CTTTGGCTAG ATGCAGGTAT CTCACAAGCT ATTTATCACC AATCTCGTGA	14280
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TGACATGGGC TTCCGTGTAT CTGTAACAGG TGGTCTAGAT GTAGATACTC TCAAATCTT	14400
TGAAGGTATT GATGTCTTTA CCTTTATCGC AGGTCGTGGA ATTACAGAGG CTGTGGATCC	14460
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AAAGTCACCC CAGACACGCC AACGTTTAT CAAAAATTG AGAAAAGCCT GTGACTGGGC	14940
TGAAGAAGCT CAGGTGGTAC TTGCTATTGA AATTATGGAT GATCCTTTCA TCAGTAGCAT	15000
CGAAAAATAT TTGGCTATAG AAAAAGAGAT TGACTCTCCC TTCTCTTTG TATATCCAGA	15060
TATTGGTAAT GTGTCTGCAT GGCATAATGA TATCTATAGT GAGTTTATC TTGGTCATCA	15120
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GTTCCGAGAT GTACCTTTCG GGCAAGGTG TGTCAAATGG GAAGAAGCTT TCGATATTTT	15240
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TGACACCTGA AAACATGGTA GTGACTGATC TAGATGGTAA GATCCTAGAA GGGGATTTAA	15600
GACCATCTTC CGACCTCCCA ACTCATGTGC AATTATATAA GACTTGGTCA GAAATGGTGA	15660
GTGTGGTTCA CACCATTCG ACAGAAGCTG TTGGTTGGGC TCAGGCAGGT CGTGATATTC	15720
CTTTCTACGG AACAAACCAT GCAGATTATT TCTACGGTTC AATCCCTTGC GCCCGTAGTT	15780
TGACCAAGGA CGAAGTAGAA GTGGCCTATG AAAAAGATAC TGGCCTGGTT ATCGTAGAAG	15840

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AGTTTGAACA TCGCGGACTT AACCCGGTTG AAGTACCAGG AATTGTTGTA CGCAATCACG	15900
GTCCATTAC CTGGGGCAAA AATCCAGAGA ATGCTGTTTA TCACTCTGTC GTACTAGAGG	15960
AAGTATCAAA GATGAATCGC TTTACAGAAC AAATCAATCC AAGAGTTGGA CCTGCTCCCC	16020
AGTACATACT AGAAAAACAC TACCAACGTA AACATGGACC AAATGCTTAT TATGGTCAAA	16080
AGTAAGAACG ATGAAGGAGG AGAAAAAGAT AAATTTAGCT CCTCTTTTTA CATTTGATTT	16140
TTATTGAGAG TAAAGTTGGA GTTGAAGTAA TTTTAAAAGA TTTTTTAGAA ATAGCGCTTG	16200
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AATATGGTAC TGGATAAGGC AAGTTGTGAT TTGCTTCAAT ATTTGATGGA TCAAGAAACG	16320
TCCAAACGA TTATGGCGAT TTCGAAAGAT TTGAAAGAGT CAAGAAGGAA AATTTATTAT	16380
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CGAATTGGTA TTCACTTAAC GGAAGAGCAG AGAGATGCTT GTTGTAAGT ATTATCGGAA	16500
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AAAATTCAGT ATCTTCAATC GCTTCTATAT CATATTTTGA TGAAGAAAA TGCCACTTTT	16800
GTATCTATTT TAGAAGATAA GATGAAAGAG AGGTTAGATG ATGAGTGTGT GCTTTCTGTT	16860
GAAATGAACC AATTTTTTAA GGAACAGGTT CCTTTAGTTG AACAGATTT AGGGAAGAAA	16920
ATAAACCATC ATGAAATAAC TTTTATGTTG CAGGTTCTAC CTTATTTGCT GTTAAGCTGT	16980
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AAGAGTGTGG AAGATATTGC ACAAGTTGAT GTAGTGATTA CTAATAATGA TGATTTGGAT	17700
AGCAGATTTC CGATTTTAAAG GGTTAATCCT ATCCTTGAAG CAGAAGATAT TTTGAAAATG	17760
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TGGKATACTA ATCTCAAAGA TAACAATTAT ATCCAAAGGA GGCAACATAT GCCAAACGTC	18060
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AACGAAGAAA TCGAAGAAGA AGTCGTACCT GAAGGCAACT TTGCCATGTG GTGGCTAGGC	18180
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TTTGCTATCA ACGAACTAGA CTATTACTTA GTTTCACACT TCCACAGTGA TCATATCGAC	18420
CCATACACAG CTGCAGCAAT TCTCAATAAT CCTAAGTTAG AGCATGTAA GTTGG	18475

## (2) INFORMATION FOR SEQ ID NO: 39:

- (i) SEQUENCE CHARACTERISTICS:  
 (A) LENGTH: 7186 base pairs  
 (B) TYPE: nucleic acid  
 (C) STRANDEDNESS: double  
 (D) TOPOLOGY: linear

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO: 39:

CCAGGATTTC GTACCGTTGC AAGTGGTGTG CCTTTCCTCC TAAAGGAAAA TGGAGGAAAA	60
ATCAATCAAT CAGCACATTC AGATATCAAA GTTGCTAAGG TATTGGTCAA GGATGAAGAT	120
GAAAAAAATC GCTTGCTTGC AGCAGGGAAT GACTTTAACT TTGTAACCAA TGTGGATGAT	180
ATTTTATCAG ACCAGGATAT TACTATCGTA GTGGAATTGA TGGGGCGTAT TGAGCCTGCT	240
AAAACCTTTA TCACTCGTGC CTTGGAAGCT GGAAAACACG TTGTTACTGC TAACAAGGAC	300
CTTTTAGCTG TCCATGGCGC AGAATTGCTA GAAATCGCTC AAGCTAACAA GGTAGCACTT	360
TACTACGAAG CAGCAGTTGC TGGTGGGATT CCAATTCTTC GTACTTTAGC AAATTCCTTG	420
GCTTCTGATA AAATTACGCG CGTGCTTGA GTAGTCAACG GAACTTCCAA CTTCATGGTG	480
ACCAAGATGG TGAAGAAGG CTGGTCTTAC GATGATGCTC TTGCGGAAGC ACAACGTCTA	540

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GTTATTTTGA GCCAATTTGC CTTTGGCATG AAGATTGCCT TTGATGATGT AGCCCAACAG	660
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GCAACAAGTG TTGTAGCTGA TATTGTCCGT ATCGTTCGTC GTTTGAATGA TGGTACTATT	960
GGCAAAGACT TCAACGAATA TAGCCGTGAC TTGGTCTTGG CAAATCCTGA AGATGTCAAA	1020
GCAAACACT ATTTCTCAAT CTTGGCTCTA GACTCAAAAG GTCAGGTCTT GAAGTTGGCT	1080
GAAATCTTCA ATGCTCAAGA TATTTCTCTT AAGCAAATCC TTCAAGATGG CAAAGAGGGT	1140
GACAAGGCGC GTGTGTTTAT CATCACACAC AAGATTAAATA AAGCCAGCT TGAAAATGTC	1200
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TGTTGAAGGG CAAGTCTCTG CTATCGTAGC AGACTTTCCA GAGTGTGATT TTCTAGCTTA	1740
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TCAGGACTTG GTAAGAGAAT TTGCGATGAT TAAGCAAGTG ACCAAAGAAA ATGGGGCCTA	1980
TGCAACCTAC CTTTCTGGTG CTGGGCCGAC AGTTATGGTT CTGGCTTCTC ATGACAAGAT	2040
GCCAACAATT AAGGCAGAAAT TGGAAGCA ACCTTTCAAA GGAAACTGC ATGACTTGAG	2100
AGTTGATACC CAAGGTGTCC GTGTAGAAGC AAAATAAAGA ATAGAAGATA GGATGGGGAA	2160
ACTCTTGACC AGAGGGGTTT ATATCCTTTT TGTGAAAAGA AGTTTATACT CAATGAAAAT	2220
CAAAGAGCAA ACTAGGAAGC TAGCCGAGG CTGCTCAAAA CAGTGTTTTG AGGTTGCAGA	2280
TAGAACTGAC GAAGTCAGCT CAAGACACTG TTTTGAGGTT GCAGATAGAA CTGACGAAGT	2340

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CAGTAACCAT	ACTACGGTAA	GGTGACGCTG	ACGTGGTTTG	AAGAGATTTT	CGAAGAGTAT	2400
TAGTTAAAAA	CGTGATAAAG	GAGAAATAAA	GATGGCAGAA	ATTTATCTAG	CAGGTGGTTG	2460
TTTTTGGGGC	CTAGAGGAAT	ATTTTTCACG	CATTTCTGGA	GTGCTAGAAA	CCAGTGTTGG	2520
CTACGCTAAT	GGTCAAGTCG	AAACGACCAA	TTACCAGTTG	CTCAAGGAAA	CAGACCATGC	2580
AGAAACGGTC	CAAGTGATTT	ACGATGAGAA	GGAAGTGTC	CTCAGAGAGA	TTTACTTTTA	2640
TTATTTCCGA	GTTATCGATC	CTCTATCTAT	CAATCAACAA	GGGAATGACC	GTGGTCGCCA	2700
ATATCGAACT	GGGATTTATT	ATCAGGATGA	AGCAGATTTG	CCAGCTATCT	ACACAGTGGT	2760
GCAGGAGCAG	GAACGCATGC	TGGGTCGAAA	GATTGCAGTA	GAAGTGGAGC	AATTACGCCA	2820
CTACATTCTG	GCTGAAGACT	ACCACCAAGA	CTATCTCAGG	AAGAATCCTT	CAGGTTACTG	2880
TCATATCGAT	GTGACCGATG	CTGATAAGCC	ATTGATTGAT	GCAGCAAACT	ATGAAAAGCC	2940
TAGTCAAGAG	GTGTTGAAGG	CCAGTCTATC	TGAAGAGTCT	TATCGTGTCA	CACAAGAAGC	3000
TGCTACAGAG	GCTCCATTTA	CCAATGCCTA	TGACCAAACC	TTTGAAGAGG	GGATTTATGT	3060
AGATATTACG	ACAGGTGAGC	CACCTTTTTT	TGCCAAGGAT	AAGTTTGCTT	CAGGTTGTGG	3120
TTGGCCAAGT	TTTAGCCGTC	CGATTTCCAA	AGAGTTGATT	CATTATTACA	AGGATCTGAG	3180
CCATGGAATG	GAGCGAATG	AAGTTCGTTT	TCGTTCAAGC	AGTGCTCACT	TGGGTCATGT	3240
TTTCACAGAT	GGACCGCGGG	AGTTAGGCGG	CCTCCGTTAC	TGTATCAATT	CTGCTTCTTT	3300
ACGCTTTGTG	GCCAAGGATG	AGATGGAAAA	AGCAGGATAT	GGCTATCTAT	TGCCTTACTT	3360
AAACAAATAA	AACAGAGAGT	GGGGCTTCCC	ACTTTCTTCA	TTTCTAGAAT	ATGAATAGAA	3420
GGGATTTATG	AAACACCTAT	TATCTTACTT	CAAACCCTAC	ATCAAGGAAT	CAATTTTAGC	3480
CCCCTTGTTT	AAGCTGTAG	AAGCTGTTTT	TGAGCTCTTG	GTTCCCATGG	TGATTGCTGG	3540
GATTGTTGAC	CAATCTTTAC	CTCAGGGAGA	TCAAGGTCAT	CTCTGGATGC	AGATTGGCCT	3600
GCTCCTTATC	TTTGCAAGTA	TTGGCGTTTT	AGTGGCCTTG	ATAGCTCAAT	TTTACTCAGC	3660
AAAGGCAGCA	GTAGGTTCTG	CTAAGGAATT	GACAAACGAT	CTTTATCGTC	ATATTCTTTC	3720
CTTGCCCAAG	GACAGCAGAG	ACCGTCTGAC	AACCTCTAGT	TTGGTCACTC	GCTTGACTTC	3780
GGATACCTAC	CAGATTGAGA	CTGGTATCAA	TCAATTCCTG	CGTCTCTTTT	TACGAGCGCC	3840
CATTATCGTT	TTTGGTGCCA	TTTTTATGGC	TTATCGAATC	TCAGCTGAGT	TGACTTTCTG	3900
GTTCTTAGTC	TTGGTTGCCA	TTTTGACCAT	TGTCATTGTA	GGGTTATCTC	GATTGGTCAA	3960
TCCTTTCTAC	AGTAGTCTCA	GAAAGAAAAC	GGACCAACTG	GTTCAAGAAA	CGCGCCAGCA	4020
ATTGCAAGGG	ATGCGGGTTA	TTCGTGCTTT	TGGTCAAGAA	AAACGAGAGT	TACAGATTTT	4080

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TCAAACCCCTT AACCAAGTTT ATGCTAGATT ACAAGAAAAG ACAGGTTTCT GGTCTAGTTT	4140
ATTAACACCT CTGACCTATC TGATTGTCAA TGGAACCTCT CTCGTTATTA TCTGGCAAGG	4200
CTATATTTCA ATTCAAGGAG GAGTGCTCAG TCAAGGTGCT CTCATTGCTC TTATCAATTA	4260
CCTCTTACAG ATTTTGGTGG AATTGGTCAA GCTAGCCATG TTGATCAATT CCCTCAACCA	4320
GTCTATATC TCAGTCAAGC GAATCGAGGA AGTCTTTGTT GAGGCTCCAG AGGATATCCA	4380
TTCAGAGTTA GAACAAAAGC AAGCTACCAG AGATAAGGTT TTACAAGTCC AAGAATTGAC	4440
CTTTACCTAT CCTGATGCGG CCCAGCCTTC TCTGAGATAC ATTTCCCTTG ATATGACTCA	4500
AGGACAAATT CTAGGTATCA TCGGGGGAAC TGGTCTGGT AAATCAAGCT TGGTGCAACT	4560
CTTACTTGGA CTTTATCCAG TAGACAAGGG GAACATTGAC CTTTATCAAA ATGGACGTAG	4620
TCCTCTTAAT TTGGAGCAGT GCGGCTCTTG GATTGCCTAT GTACCTCAA AGGTCGAACT	4680
CTTTAAAGGA ACCATTGCTT CCAACTTGAC TCTAGGTTTC AATCAAGAAG TATCTGACCA	4740
GGAAGCTCTGG CAGGCCTTGG AGATTGCGCA AGCTAAGGAT TTTGTCACTG AAAAGGAAGG	4800
ACTCTTGGAT GCTCTAGTTG AGGCAGGGGG GCGAAATTC TCAGGTGGAC AAAACAAAAG	4860
ATTGTCTATC GCGGAGCAG TCTTGCGCCA GGCTCCGTTT CTCATCCTAG ATGATGCAAC	4920
CTCGGCACTG GATACCATTA CAGAGTCCAA GCTCTTGAAA GCTATTAGAG AAAATTTTCC	4980
AAACACGAGC TTAATTTTGA TCTCTCAACG AACCTCAACT TTACAGATGG CGGACCAGAT	5040
TCTCCTCTTG GAAAAAGGTG AGTTGCTAGC TGTGGCAAG CACGATGACT TGATGAAATC	5100
CAGCCAAGTC TATTGTGAAA TCAATGCATC CCAACATGGA AAGGAGGACT AGAATGAAAC	5160
GACAAACTGT AAACCAGACG CTCAAACGTT TAGCCGTAGA TTTAGCAAGC CATCCTTTCC	5220
TCCTTTTCCT AGCCTTTCTA GGAAGTATTG CCCAAGTTGG CTTATCAATT TACCTACCTA	5280
TTCTGATTGG GCAGGTCATT GACCAAGTCC TAGTGGCTGG TTCATCACCA GTTTTTTGGC	5340
AGATTTTCT CCAGATGCTC TTGGTGGTAA TAGGAAATAC TCTGGTACAA TGGGCCAATC	5400
CTCTCCTCTA TAATCGTCTA ATCTTCTCTT ATACCAGAGA TTTACGGGAG CGAATCATCC	5460
ATAAGCTCCA TCGTTTACCG ATTGCCTTTG TAGATAGGCA AGGTAGTGA GAGATGGTTA	5520
GTCGTGTAAC CACGACATC GAACAGTTGG CAGCTGGCTT GACCATGATT TTTAACCAAT	5580
TTTTCATGG TGTTTTGATG ATTTTGGTCA GTATTCTAGC CATGCTCCAA ATTCACTCTC	5640
TCATGACTCT CTTAGTCTTG CTGTTGACGC CACTGTCCAT GGTGATTTC CGCTTTATTG	5700
CCAAGAAATC CTATCATCTC TTCCAGAAGC AAACAGAGAC GAGGGGAATT CAGACTCAGT	5760
TGATTGAAGA ATCGCTTAGT CAGCAGACTA TAATCCAGTC CTTCAATGCT CAAACAGAAT	5820
TTATCCAAAG ATTGCGTGAG GCTCATGACA ACTACTCAGG CTATTCTCAG TCAGCCATCT	5880

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TTTATTCTTC AACGGTCAAT CCTTCGACTC GCTTTGTAAA TGCACTCATT TATGCCCTTT 5940  
TAGCTGGAGT AGGAGCTTAT CGTATCATGA TGGGTTTCAGC CTTGACCGTC GGTCTTTTAG 6000  
TGACTTTTTT GAACATATGT CAGCAATACA CCAAGCCCTT TAACGATATT TCTTCAGTGC 6060  
TAGCTGAGTT GCAAAGTGCT CTGGCTTGCG TAGAGCGTAT CTATGGAGTC TTAGATAGCC 6120  
CTGAAGTGGC TGAACAGGT AAGGAAGTCT TGACGACCAG TGACCAAGTT AAGGGAGCTA 6180  
TTTCCTTTAA ACATGTCTCT TTTGGCTACC ATCCTGAAAA AATTTTGATT AAGGACTTGT 6240  
CTATCGATAT TCCAGCTGGT AGTAAGGTAG CCATCGTTGG TCCGACAGGT GCTGGAAAAT 6300  
CAACTCTTAT CAATCTCCTT ATGCGTTTAT ATCCCATTAG CTCGGGAGAT ATCTTGCTGG 6360  
ATGGGCAATC CATTATGAT TATACACGAG TATCATTGAG ACAGCAGTTT GGTATGGTGC 6420  
TTCAAGAAAC CTGGCTCACA CAAGGGACCA TTCATGATAA TATTGCCTTT GGCAATCCTG 6480  
AAGCCAGTCG AGAGCAAGTA ATTGCTGCTG CCAAAGCAGC TAATGCAGAC TTTTTCATCC 6540  
AACAGTTGCC ACAGGGATAC GATACCAAGT TGGAAAAATG TGGAGAATCT CTCTCTGTGC 6600  
GCCAAGCTCA GCTCTTGACC ATAGCCCGAG TCTTTCTGGC TATTCCAAAG ATTCTTATCT 6660  
TAGACGAGGC AACTTCTTCC ATTGATACAC GGACAGAAGT GCTGGTACAG GATGCCTTTG 6720  
CAAACTCAT GAAGGGCCGC ACAAGTTTCA TCATTGCTCA CCGTTTGTC ACCATTTCAGG 6780  
ATGCGGATTT AATTCTTGTC TTAGTAGATG GTGATATTGT TGAATATGGT AACCATCAAG 6840  
AACTCATGGA TAGAAAGGGT AAGTATTACC AAATGCAAAA AGCTGCGGCT TTTAGTTCTG 6900  
AATAAGCCAT TCTCTTTTGA AAGTTTATGG ACGAAAAAAG TTGCCTTCGA GTGACTTTTT 6960  
TGTTACAATA GCTAGAAAAA TTGTTCACTG TAATACTCAA TGAAATCAA AGAGCAAAC 7020  
AGGAAGCTAG CCGTAGGTTG CTCAAAGCAC AGCTTTGAGG TTGTAGATAA GACTGACGAA 7080  
GTCAGTTCAA AACACTGTTT TGAGGTTGCA GATAGAACTG ACGAAGTCAG CTCAAAACAC 7140  
TGTTTTGAGG TTGCAGATAG AACTGACGAA GTCAGCTCAA AACAGG 7186

(2) INFORMATION FOR SEQ ID NO: 40:

- (i) SEQUENCE CHARACTERISTICS:  
(A) LENGTH: 14273 base pairs  
(B) TYPE: nucleic acid  
(C) STRANDEDNESS: double  
(D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 40:

CTGAAAATTC TAAAAAATTT ATAAGTAAGG AATTAATTAG TTATTTTGT GATAAAGTTT 60

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ATGATGAAAT ATTTGTTGAA GAGGTAGTTC CGCACGTTTT TCTGCCATAT GAATCTGACT	120
TACTTCTTAT TTTACCAGCT ACGGCAAATG TGATTGGCAA AATTGCTAAT GGTATMGCTG	180
ATGATTTAGT TACAGCAACT GTTTTAAACT TTAATAAAAA AATAATTTTT TGTCCCAATA	240
TGAACTCTAC TATGTGGGAC AATCACATAG TTCAAAGAAA TGTATCAATT CTAAGGAGT	300
TGGGACATAT ATTTTATTT GAGTCTAAAA AAACATATGA GGTAGGATTG CGTAAAGCAA	360
TAGATTCAAC ATGTTCAATG TTACAACCAC AGTCGTTAGT AAAAGAACTT ATCAAATTAG	420
AAAATATTGT CCTTGAAGAG GGACATTAAT AACTACTGAG AATATTAATG AGGGGAAAAA	480
ATGGAAAAAT CATCAATCGA TGTAGATATG CTGTTGGAAG AATTGACACA AGAAGCAATG	540
GTCGTTGTG CTGTTGATAA GGACTGTTAA TTTAAACTTA TGGCAATATA TGAAAGGTTA	600
CTGGATGTTT TAAATTATGC AGGCAGTAGC CTTTATTAT ATACAAATGG ATAAAGTAAG	660
GATAATACAA TGATTAATAA AAAAATACAA CAAGTTGTTT TGGAAATCATT ACAGAATTTT	720
TTGAATGGGA ACTTCATTTC GCCTTGTGTA GTCTATGATT TTGGCTTGCT GGAACTGTA	780
CTTGATGAAT TAAAAATCA AATTCCTGTA ACATTCAATT ACCAACTTTT TTATGCCGTT	840
AAAGCAAAAT CAAATGAGAA GATACTTGAA TTCTTAGTAG ATAAAATTGA TGGAGTTGAT	900
GTGGCGTCAT TATCTGAATT AGATGTGGCT AAAAAATTTT TCCCACCAAC TCAAATTTCT	960
GTTAATGGTC CCGCATTTTC TTATGAACT TTATATAATC TGATTAAAAA ACAATATAAA	1020
GTTGATATTA ACTTTTGGGA ACATCTTCAA CAATTTTCCC CAAAAGAATC TGTGGAATA	1080
AGAGTAACGG AGCCAGATGA ACTTAATAAT CGTATGAGTC GATTGGAAT AAATATTTGC	1140
AGTGATAATT GGACTAGTAA TTTACAAAAT CCTTTAATTA CACGACTGCA TTTTCATTTT	1200
GGAGAAAAAG ATGATAAATT TATTGTTAAG TTAGATAAAA TATTATTTAA GTTACAAGAA	1260
ATTAATAAAC TTAGAGAGGT TAGAGAAATA AATCTTGGAG GCGGTTTTAT GAAATTATTT	1320
ATGGAAAAATC GTTTGAAAGA ATTTTCTCTA TCACTTATGG AAATCTATAA AAAGTACGAT	1380
ATTGATAGTA CTGTGACTAC AATAATAGAA CCAGGTAGTG CAATTACTTC ATTTTCTGCC	1440
TATATGATTA CTAGCCAGT TAATGTTAGT GAGGTGAATG AGCAGCAGGT TATCACGTTA	1500
GACACATCAA TATACACCAA TACATTATGG TTTGTTCCGC ATATTATTAC AACGTAAAT	1560
TCAAGTAGTA AAGAGCGTTA TAGTACTATT CTCTATGGTA ATACCTGTTA TGAACATGAC	1620
AAGTATAAAA TGAAAGTTTC GCTTCCAAGG TTAAC TAAA ATAGCAGTAT AGTGTTTTTT	1680
CCTGTAGGAG CTTATATAAA AAGCAATCAT TCAAATTTAC ATCGTAATGA TTTTATGCGG	1740
GAGGTATATT TGTGGACAAA AAACCTTGACA TATTAGATAA AGTTAAGGAA TATTTAGGAA	1800
ATAAACTAC TCAAATTTCTG GATAATCAAT ATAAAGAATT TTTGAACTT AATGATATAA	1860

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GGCGAGCGTT TGGTATTTCA GAAAAAGTAT TAAACAATTC TTTTAATTTT ACGAGTAAAG	1920
AATTTAATGA TTTAATTAAT AACGAAAATT ATTTATTCGA ATATGCATGT AGAATTAGAG	1980
AGGAATGGAG AAAAAAATGC TTTAATCATT CTTATCGTTT TCTATGCTCA CCTATAATTA	2040
CAGATGATTT TCTTAACACG AAGACATTGA GAAGTAGCCA AATTGAATAT AAATATGAGC	2100
GATATTTATC GAAAAGTTCG ATAGGCGATA GAGCGGTGA TGGCTTTGTT TCCTTCAATA	2160
CTTTAACAGC TAATGGTATG TCTGCTATTA AACTATGTCT TGAGATATTA AACTCTATTT	2220
TCTTCAAGAA GAAGATTGAT TTATTATATT CAACCGGATA TTATGAAACA AGATTTTAT	2280
TAAATAATCT TGCTAAATCA GGTATTAGTT GCTATGAGGT AAGTAATTGT GAATTGGATA	2340
AAGATAAATT TTATAATGTA TTCATGATGG AACCCAATCG AGCCGATTTA ACATTACAAA	2400
AAACTGATTT CAAGATAGTA GAATATTTTG TTAAGTATAA AAATAATTCA ATAAAAGTCG	2460
TTATTTTAGA TATTTTCATAT CAAGGTCTA ATTTTAAATT AGTAGAATTT TTAGAGAAAT	2520
TTAAATTTGC GAATGTAATT ATTTTGTGG TACGATCTTT GATAAAATTA GATCAATGG	2580
GATTAGAATT GACAAATGGG GGAATAATAG AAGTGTAT TCTAATCAT TTGAGAAAGT	2640
TGAAAAATTT TATTGAAGAG GAATTCATA AATTAGAAA TTCTCACGGA GCTAATCTAA	2700
GCCTCTATGA ATACTGTTTG CTTGATAATT CTTTAACTTT AAAAAATGAT TGGAACTATT	2760
CTGATTTAGT TATGAAATTT ACGAGTAATT TTTATGCTGA TATAAAGAC TTGTTTCATGG	2820
AAAATTCGA TATTGAAATC ATCCATGAAG AGGGAGTACC TTTTGTATTT TTAGATTTAA	2880
TAGGTGAAGG TAAAAAAGAA TATGAAATGT TTTTCAATG GTTAACTTC TTTTACAAAC	2940
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ATTTTGAAT TATTGGGACA GAAAGATATA TATTTAAGAT TTGTCCAGGT GTTTATAAAG	3060
GGTTAAGTTA TTATTTGATG AAATTTTAT TAAAATCTTT TTCAAATGAA TATTTAAAAA	3120
CTACTGATGA GGTAAATAGA TGAAAAATTT GATAAAGTTG CTAATAATTA GATTGATTGT	3180
TAACTTAGCA GACAGTGAT TTTATATAGT AGCATTGTGG CACGTTAGCA ATAATTATTC	3240
TTGAGCATG TTCTTAGGAA TATTTATTGC AGTAAATTAT CTACCGGATT TGTTACTAAT	3300
CTTTTTGGA CCAGTTATTG ACAGAGTAAA TCCGCAAAAA ATTCTTATAA TATCAATTTT	3360
GGTTCAATTA GCAGTGGCTG TAATATTTT ATTATTATTA AACCAATAT CATTTTGGGT	3420
GATAATGAGT CTAGTGTTA TTTGAGTAAT GGCTAGCTCC ATAAGTTACG TGATAGAAGA	3480
TGTGTTGATT CCTCAAGTGG TAGAATATGA TAAGATTGTA TTTGCAAATT CTCTTTTAG	3540
TATTTCTGAT AAAGTATTAG ATTCTATTTT TAATTCATTC GCATCATTTT TACAGGTGGC	3600

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AGTAGGATTT ATTTTATTGG TTAAGATAGA TATAGGCATA TTTTACTTG CTCTATTTAT	3660
ATTGTTGTTG TTAATAATTA GAACTAGCAA TGCGAATATA GAAAACCTCT CTTTCAAATA	3720
TTACAAGAGA GAAGTGTTGC AAGGTACAAA GTTTATTTTA AATAATAAAT TATTATTTAA	3780
AACCAGTATT TCTTTAACGC TTATAAACTT TTTTATTCA TTTCAGACAG TAGTTGTACC	3840
GATTTTTTCT ATTCGATATT TTGATGGTCC GATTTTTTAT GGTATTTTTT TAACTATTGC	3900
TGGTTTGGGT GGTATATTGG GAAATATGCT AGCGCCAATC GTAATAAAAT ATTTAAAATC	3960
GAATCAAATT GTTGGTGAT TCTTTTTTTT GAACGGCTCA AGTTGGTTAG TAGCAATTGT	4020
TATAAAAGAC TATACTTTAT CACTTATTTT ATTTTTCGTT TGTTTTATGT CTAAAGGAGT	4080
CTTCAATATT ATTTTAAAT CGTTGTACCA ACAAATACCT CCACATCAAC TTCTTGGTAG	4140
GGTAAATACT ACCATTGATT CTATTATTTT TTTTGGAATG CCAATTGGTA GTTTAGTTGC	4200
AGGAACGCTT ATTGATTGA ATATTGAATT AGTGTTAATT GCTATTAGCA TACCTTATTT	4260
TTTGTTTTCT TATATTTTTT ATACGGATAA TGGATTGAAA GAATTTAGTA TATATTAGAA	4320
ATGTTTATGT TCATTCAAAA GCATAATGAC TATAACTGAA AAAGAAAAGT GATATCTTTA	4380
AGGTTGTTCT TCTTGGTGGT GAGATTCGTG AGACAACCCA AGCTTTTGTG GGAAAGATTA	4440
CCAATGCTTT GATGGATAGG ATGTACTTTA GCAAGATGTT TTTAGTGGTA ACGGTATCGT	4500
GGATGGACGT GTAATAACCT CTTCTTTCGA GGAGTATTTT ACTAAAAAAC TAGCCTTGGA	4560
GCGTCCCCA GAAACGGA CTCTCATTGA CTCTCAAAG ATTTGGGGAG AAGATTTTGC	4620
TTCATCTGTT CCTTGAAAAA AGTCACAGCA GTCATCACAG ACGATAGTAC TGAACAAAAC	4680
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AGTTGATTAG TATTGACCTA GGTGGTACAA ATATTAAGAT TACTGTTCTT TCAAATGACG	4800
GTGAGATTGA AACTTTGTGG AGTATTACAA CAGATACAAG TGAGAAAGGT TCTCAAATTA	4860
TATCGGACAT CATCAGTTCT ATTAATAATA AATTGACCGA ACGGAATATT CCTGATAGCG	4920
ACCTTCTTGG AATCGGTATG GGAAGTTGCT CATCATACTT TCCTTGTAAG TCATAGGGGC	4980
TATAAACTCT CCGCTACTT GTCTGCAAC AATTGAAGTC TGCTCAAAAC GCCGTCCGCT	5040
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TGGGCTCCTA TGTGGTGGAG CTTTCTGTT CTTTCTGAAA TATGGTATAA TAGCACTAAT	5220
CAATTTCTAG GAAAATAGAT ACAGAAAGGG GCTGAAAGAT GTCTCATATT ATTGAATTGC	5280
CAGAGATGCT GGCAAACCAA ATCGCGGCTG GAGAGGTCAT TGAACGTCCT GCCAGTGTGG	5340
TCAAAGAGTT GGTAGAAAAT GCCATTGACG CGGGCTCTAG TCAGATTATC ATTGAGATTG	5400



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AGGTGGAGTT GGCCTGCGT CGCCATGCGA CCAGTAAGAT AAAAAATCAA GCAGATCTCT	5520
TTCGGATTTC GACGCTTGGT TTTCGTGGTG AAGCCTTGCC TTCTATTGCG TCTGTTAGTG	5580
TCTTGACTCT GTTAACGGCG GTGGATGGTG CTAGTCATGG AACCAAGTTA GTCGCGCGTG	5640
GGGGTGAAGT TGAGGAAGTC ATCCCAGCGA CTAGTCCTGT GGGAAACCAAG GTTTGTGTGG	5700
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TGTCTCATAT CATTGATATT GTCAACCGTC TGGGCTTGGC CCATCCTGAG ATTTCTTTTA	5820
GCTTGATTAG TGATGGCAAG GAAATGACGC GGACAGCAGG GACTGGTCAA TTGCGCCAAG	5880
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GGCAGGATTT GACCCTGTTT GCCAAGGAAA CCTTGGACCG ATTGACCAAG CCAGCAAAAC	6480
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TTTACATCAT AGATCAGCAC GCTGCTCAGG AACGGGTCAA GTACGAGGAG TACCGTGAAA	6720
GCATTGGCAA TGTTGACCAA AGCCAGCAGC AACTCCTAGT GCCCTATATC TTTGAATTC	6780
CTGCGGATGA TGCCCTGCGT CTCAAGGAAA GAATGCCTCT CTTAGAGGAA GTGGGCGTCT	6840
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AGGCCAATCA TCGTATTGAT GATCATTCAG CTAGACAACT CCTCTATCAG CTTTCTCAAT	7080
GTGACAATCC CTATAACTGT CCTCACGGAC GTCCTGTTT GGTGCATTTT ACCAAGTCGG	7140

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ATATGGAAAA GATGTTCCGA CGTATTCAGG AAAATCACAC CAGTCTCCGT GAGTTGGGGA	7200
AATATTAAAA GTATAAAAA GTCTGGGAAA AATTTTCAAA ATCAAAAAAA CGCATAAAAT	7260
CAGGTGTTCA AAAACCTTGA TTTTATGCGT TTTATCATGG AAATAGTTAC TTCATTTTTT	7320
CCTAATTCTT TTCGAAACTC TTTTAAACG ACGTCAGTTT TATCAGTAAT CTCAAAACAG	7380
TGTTTTGAGC TAATTTTGCC AGTTTGTCT GTAACATCGA AGTTGTGTTT TACCACTCTG	7440
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GTTTCTTTAT TCGTCTAAAA GTAGAGCTG TTTATGCGT CTAATGTACG AATCAGGTTG	7560
ACCATTTCAA TAGCTCCTTG TGCACACTCA GAACCTTAT TTCTGCTTT AGTACCAGCT	7620
CGTTCTATGG CTGTTC AAT TGTATCTGTC GTTAGCACAC CAAACATAAC AGGAATTCG	7680
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GAAACTCGTT CTACCAGCTG ATCATATACT TTTCTATATT CTGTAAATC TTTGATGGTA	8640
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GCCATAAAAT TAACATTTTC TGTGTAGCT GCTTGTGCAG AACAAATTAA GTCTCCTTCA	9120
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GCTTCTTGTA TTTTTCGATA TTCCATTGAC TGATTATCCT TTCTGCTAAA ATCCATTTTG	9240
ATATAATAGT TCCTTAGATA TTTCTGATTT TGGAGAGTTA TCCATCAGTT TTTGCACATA	9300
TTTACCTAAG ATATCATTTT CAAGATTAC TGTACTCCCG ACTTGTTTAC TCTTAAGAAT	9360
GGTTTGTTC AAGGTATGAG GGATAACAGA TACTGAAAAG TTTACTTTGG AGACTTTAGC	9420
GACAGTCAGA CTAATGCCGT CAATTGTAAT AGATCCTTTT TCAACTATTA AATCTAAAAT	9480
TTCTTTTGT GTGTTGATTT GATACCATAC AGCATTATCA TCTTTTTTTA TTGACGAGAT	9540
TTTTCTGTA CCATCAATGT GTCTGTAAAC GACGTGACCC CCAAGTCGAC CGTTGACAGA	9600
TAAGGCTCTT TCTAGATTCA CCTCACTTCC ATGTTTTAAT AGAGTAAGAG CTGTTGACT	9660
CCATGTTTCA TTCATTACAT CAACTGTAAA GGATTGATGA TTGAAATGAG TAACTGTAAG	9720
ACAGATACCA TTTACTGCTA TACTATCGCC TAAATGGATA TCCGTTAATA TTTTGAGGC	9780
TTTAATTGAT AGTTTACAAT TACGAGAGTC TTTCTGTATT CTTTCAACTT TTCCGATTTC	9840
TTCAATTATT CCTGTGAACA TGGATAAATC ACTTCACTTT CTATGAGATA GTCATTTCTT	9900
ATTTGAGAAA ATGCATAAGG TTTCAATCTA ATAGCGTCAT TTGGCAAAGA AATACCTTCA	9960
CCTCCGACAG GAAACTTGGC ACTACCTCCA AAAACTTTTG GTGCAATATA TATTTTCAGC	10020
TCATCAACAA TTTGTTGTTT CAAAGCACTC CAATTCATTA GACTGCCCCC TTCTAGAACT	10080
AGGCTATCAA TCTGCATGTT TCCTAGATGT TGCATTAAAC TCGATAAGTC TATATGATTG	10140
CCTTTTTTCT TTATGGAAAG TATTTACAG CCATGATTTT GATATAGCTT CATTTTATTT	10200
TTGTCTTCAG AGGAAGTGGC AATGTAAGTT TTAATATCAT TTGCTGTTTT TACGATTTTA	10260
GAGGTAAGAG GAGTTCGTAA ATGTGTATCG CATATGATAC GGATAGGATT TTTCCCTTCC	10320
TCCAATCTAC ATGTCAGCAA AGGATCGTCT TGAATAACAG TATTGACTCC CACCATAATT	10380
GCACTAACAT GGTGTCGTAA CTGATGCACA TGCTTCTTG CTCTTCTTTC AGTAATCCAT	10440
TTGGATTGAT TTGTTTGTAGT GGCTATTTTT CCATCCATTG ACATTGCATA TTTCATAAAA	10500
ACATAGGGTA CATGCTGGGT AATATACTTT CTAAAACTTT TTATTAAGTT AAGACACTCA	10560
TTTTCTAAAA TTCCAACAGT AACTTGAAGA TTATTTTCCT CAAGTATCTT TACTCCTTTT	10620
CCAGATACAA TAGGATTACA GTCTAGGCTT CCAATGACTA CTCTTGTAAT ACCACTATCG	10680

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ATTATAGCAT CTATACAGGG AGGTGTTTTT CCGAAGTGAC AACAGGGTTC AAGTGTTACA	10740
TAAAGCGTCG CTCGACAGG GGATTCTCTA CAGTTTTTAA GAGCATTTCT CTCAGCATGT	10800
GGGCCACCAA AAAACTCATG ATAACCTTGT CCGATAATGT GATTATCTTT TACAATAACT	10860
GCGCCGACCA TAGGATTGGG ATTGACGTAA CCAGCCCCCT TTTGTGCCAG TTTTATTGCT	10920
AATTTTCATAT ATTTTGAATC GCTCATCTCG CTACCTCCAA AAAAATATAC CTGAATAGG	10980
GGACTACTCA AGGCATACAA AAGAAAACCT ATGCGATTAA CAAAAATGCT CTGAAATGAC	11040
AAGTAATCAT TTCAGAGCAC GCAAAAAGCA CAAATATACT TTTATCTTCT TTCATCCAGA	11100
CTATACTGTC GGCTTTGGAA TTTCACCAA TCATGCCTTT CGGCTCGTGG GCTATACCAC	11160
CGGTAGGGAA TTTCACCTCG CCTGAAGAT AGTTATTCAA TTACAGATGA TTATAGTACT	11220
TAATTTTGAA TATGTCAACA GATAAATACC GATTGTTTTT GATATACTGT ATTTGTGATA	11280
ATCGATTCTC GCTCCTCGGA TAAAGAAAAT ATGATATACT AGATAAACGA AATAAGAGAG	11340
AAGGAATACT ATGTACGCAT ATTTAAAAGG AATCATTACC AAAATTACTG CCAAATACAT	11400
TGTTCTTGAA ACCAATGGTA TTGGTTATAT CCTGCATGTG GCCAATCCTT ATGCCTATTC	11460
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CTCTGGGATT GGTCTGTAT CAGCTCTGCT TATTATCGCT GCTGATGACA ATGCTGGCTT	11640
GGTTCAAGCC ATTGAAACCA AGAACATCAC CTACTTGACC AAGTTCCCTA AAATTGGCAA	11700
GAAACAGCC CAGCAGATGG TGCTGGACTT GGAAGGCAAG GTAGTAGTTG CAGGAGATGA	11760
CCTTCTGCC AAGGTGCGAG TGCAAGCAAG TGCTGAAAC CAAGAATTGG AAGAAGCTAT	11820
GGAAGCCATG TTGGCTCTGG GCTACAAGGC AACAGAGCTC AAGAAAATCA AGAAATCTT	11880
TGAAGGAACG ACAGATACAG CTGAGAACTA TATCAAGTCG GCCCTTAAAA TGTGTTGTC	11940
ATAGGAGCAG AGAATGACAA AACGTTGTTT GTGGGTCAAG ATGACCAACC CGCTCTACAT	12000
CGCCTATCAT GATGAGGAGT GGGGCCAGCC CCTCCATGAT GACCAAGTAT TGTTTGAGTT	12060
GTGTGTATG GAAACCTATC AGGCAGGCCT GTCTTGGGAA ACGGTACTCA ACAAACGCCA	12120
AGCTTTCCGA GAAGTCTTTC ATAGCTATCA AATCACTCA GTCGCAGAGA TGACTGACAC	12180
TGAATTGGAA GCCATGCTGG AGAATCCAGC TATCATTCGA AATAGAGCCA AGCTTTTGC	12240
TACACGCGCT AACGCCAAG CCTTTCTACA GTTACAGGCA GAGTACGGCT CTTTGTATGC	12300
CTATCTTTGG TCTTTTGTG AGGGGAAAAC TGTCGTTAAC GATGTTCTTG ATTATCGCCA	12360
AGCGCCAGCT AAAACACCCT TATCTGAGAA ATTAGCCAAA GATCTCAAAA AACGAGGCTT	12420
CAAGTTCACA GGCCAGTCG CCGTATTGTC TTTTCTACAG GCTGCAGGCG TAGTTGATGA	12480

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CCACGAGAAT GATTGTGAGT GGAAAGGTCT TAAATGATGT CTAACAAAAA TAAGGAAAT	12540
CTGATTTTTC CGATTCTCTA TACAGTCCTC TTTATGTTTG ATGGCGTTAA ATGCTGGCT	12600
TCTTTAATGC CATCTGCCAT TGCAAATTAT CTTGTTTATG TAGTTTTAGC TCTATATGGC	12660
TCCTTCTTGT TCAAGGATAG ATTGATCCAA CAATGGAAGG AGATTAGAAA GACTAAAAGA	12720
AAATTCCTCT TTGGAGTCTT AACAGGATGG CTCCTTCTCA TTCTGATGAC TGTGTCTTT	12780
GAATTTGTAT CAGAGATGTT GAAGCAGTTT GTGGGACTAG ATGGACAAGG TCTAAATCAG	12840
TCTAATATTC AAAGTACCTT TCAAGAACAA CCACTACTGA TAGCTGTTTT TGCTTGTGTC	12900
ATTGGACCTC TGGTAGAAGA ATTATTTTTC CGTCAGGTCT TATGTCATTA CTGTCAGGAA	12960
CGGTTGTCAG GTTTACTAAG CATTATTCTG GTAGGACTTG TTTTGTCTCT GACTCATATG	13020
CACAGTTTGG CTCTATCAGA GTGGATTGGT GCAGTTGGTT ACTTAGGTGG AGGCCTTGCC	13080
TTTTCTATTA TTTATGTGAA AGAAAAAGAG AATATCTACT ATCCCCTACT TGTTCACATG	13140
TTAAGCAACA GCCTCTCCTT AATCATTTTA GCTATCAGTA TAGTAAATG AAATGAGAAC	13200
AGGACAAATC GATTTCTAAC AATGTTTTAG AAGTAGAGGT GTACTATTCT AGTTTCAATA	13260
TACTGTAATA TGTGATGAAA ATGCCAGTAA TGATACCGAG AAAAAAGCTG AGAACTTTT	13320
CCCAGCTTTA TTTGTTATAG TCAAAGAGAA TGACTTGTTT CTGTGCATCT ACATGAGCAT	13380
GGACCCCAAA GGTACAATT GCTCTTGGAG TTGCGTGGCC GACATTCAGA TTATAGACAA	13440
TCGGGATATT GCTGTCAATG ATATCCAATA GTGCCTCTTT ATAGTCGTCA TGGAAAGTTT	13500
CATCCATAGG TTTTCCGACC AAGAGTCCAT TGATGACCGC GAATATGCCA GTGTCCTTTA	13560
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AGAGGATTTT CCCTTCCCAG TCTGACAAGT CAGGGAAAAG TTTGTATTTT TGGCAGAGTT	13680
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CGAGGATTTT CCCCTCGAAC TGGGCACTTC CTTGCAACAA GTCAAAACCT GTATTTGTAT	13800
GACTGACACG AGGTGTTCCC AGGGCCGTGG GACTAAAATC AGTTCGTTCC TCATACCAA	13860
CGTCACTAGG GCGGATTTCT GAAATCTTTC CCGTCTCAAT CAATTCCTTA AAGTAGTGAA	13920
GGCTATAGGC TAGCATTTCT TTGTCTAATT CACAAATGTC TGCTAAAAAG GATTGACCAT	13980
AAAAAGTCTT GATTCCTAAT TTATGCAACA TGAGGTGGTT CATGGTTGTA TCCGAGAAGC	14040
CAAGAAAAAT TTTTGTCTTG ATAACCTTTT GGAGTTGGTC ATTTTCAAAA AGATAAGGTA	14100
GCAAGCGATA GGTATCGTCT CCACCGATGG CACATAGGAT CATGTCGATG CTATCATCAG	14160
AAAAGGCATG AATCAAATCC TCTGCACGAG CTTCAGGATG GTCCTTGATA AAGTCTAATC	14220

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CTTTTAACGA ATGGGGCAAA AAGATGGGAT TGGTCCCAGA TCCTTGAGAC GTT

14273

## (2) INFORMATION FOR SEQ ID NO: 41:

## (i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 9828 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: double
- (D) TOPOLOGY: linear

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO: 41:

GTGAAGTGGC GCAAAAGGTG CAAGTGATGA GCTCAGGTTT TTAGCTCTT GACATTGCCC	60
TTGGCTCAGG TGGTTATCCT AAGGGACGTA TCATCGAAAT CTATGGCCCA GAGTCATCTG	120
GTAAGACAAC GGTGCGCCTT CATGCAGTTG CACAAGCGCA AAAAGAAGGT GGGATTGCTG	180
CCTTTATCGA TCGGAACAT GCCCTTGATC CAGCTTATGC TCGGCGCCTT GGTGTCAATA	240
TTGACGAATT GCTCTTGTCT CAACCAGACT CAGGAGAGCA AGGTCTTGAG ATTGCGGGAA	300
AATTGATTGA CTCAGGTGCA GTTGATCTTG TCGTAGTCGA CTCAGTTGCT GCCCTTGTTT	360
CTCGTGGCGA AATTGATGGA GATATCGGAG ATAGCCATGT TGGTTTGAG GCTCGTATGA	420
TGAGCCAGGC CATGCGTAAA CTTGGCGCCT CTATCAATAA AACCAAAACA ATTGCCATTT	480
TTATCAACCA ATTGCGTGAA AAAGTTGGAG TGATGTTTGG AAATCCAGAA ACAACACCGG	540
GCGGACGTGC TTTGAAATTC TATGCTTCAG TCCGCTTGGA TGTTCGTGGT AATACACAAA	600
TTAAGGGAAC TGGTGACCAA AAAGAAACCA ATGTCGGTAA AGAACTAAG ATTAAGGTTG	660
TAAAAAATAA GGTAGCTCCA CCGTTTAAGG AAGCCGTAGT TGAAATTATG TACGGAGAAG	720
GAATTTCTAA GACTGGTGAG CTTTGAAGA TTGCAAGCGA TTTGGATATT ATCAAAAAAG	780
CAGGGGCTTG GTATTCTTAC AAAGATGAAA AAATTGGGCA AGGTCTTGAG AATGCTAAGA	840
AATACTTGGC AGAGCACCCA GAAATCTTTG ATGAAATTGA TAAGCAAGTC CGTTCTAAAT	900
TTGGCTTGAT TGATGGAGAA GAAGTTTCAG AACCAAGATC TGAAAACAAA AAAGATGAGC	960
CAAAGAAAGA AGAAGCAGTG AATGAAGAAG TTCCGCTTGA CTTAGGCGAT GAACTTGAAA	1020
TCGAAATTGA AGAATAAGCT GTTAAAGCAG TGGAGAAATC CGCTACTTTT TCGATTTTTC	1080
ATTCAGTTT TTAGATTATA TATAGTAGCT TGAAATAAGA TATGAACAAC TCTATTAGGA	1140
AAGTCAAATT AATTCTAGA AATGTTTTCAG CAGCTACAGC GTACTATTCC AAATCAACC	1200
AACTATAATA GATCGAAACT AGAATAGTAC ATATCTACTT CTAAACATT GTTAAAAATC	1260
GATTTGACTT TCCTTATTTT ATTCGCTAT ATATAGTTTG CTGTTTCTTG TCGCTCCTCT	1320
GGAAAGCTGA TATAATAGCT TTATGAATAA AAAACGAACA GTGGACCTGA TACATGGTCC	1380

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GATTCCTCCC TCGCTCTTAA GCTTCACCTT TCCAATTTTG CTATCAAATA TTTTCAACA	1440
GCTCTATAAC ACTGCTGATG TCTTGATTGT TGGACGATTT CTGGTCAAG AATCCTTGGC	1500
TGCAGTAGGA GCGACGACAG CGATTTTGA CCTGATTGTA GGTTTTACAC TTGGTGTGG	1560
CAATGGCATG GGGATTGTCA TTGCTCGTTA TTATGGGGCT CGGAATTTCA CTAATAACAA	1620
GGAAGCAGTA GCAGCCACCT GGATTTTAGG TGCTCTTTTG AGCATTCTAG TTATGTTGCT	1680
GGGCTTTCTT GGCTTGTATC CTCCTTGCA ATACTTAGAT ACTCCTGCAG AAATCTTCC	1740
TCAATCTTAT CAATATATTT CTATGATTGT GACCTGTGTA GGTGTCAGCT TTGCTTATAA	1800
TCTTTTGA GGCCTTGTGC GGTCTATTGG TGACAGTCTA GCAGCCCTGG GATTTCTGAT	1860
TTTCTCTGCC TTGGTTAATG TGGTCTGGA TCTCTATTTT ATTACGCAAT TGCATCTGGG	1920
AGTTCAATCC GCAGGACTTG CTACCATTAT TTCGCAAGGT TTATCAGCGG TTCTCTGCTT	1980
TTATTATATT CGTAAAGTG TGCCAGAACT CTTGCCACAG TTTAAACATT TCAATGGGA	2040
CAAAAGCTTG TACGCGGATC TCTTGAGCA AGGTTTGGCT ATGGGCTTGA TGAGTTCAAT	2100
TGTATCTATC GGCAGTGTGA TTTTACAGTT TTCTGTTAAT ACATTTGGTG CAGTGATTAT	2160
TAGTGCCAG ACGGCAGCTC GACGCATTAT GACCTTTGCC CTTCTTCTTA TGACCGCTAT	2220
TTCTGCATCA ATGACGACCT TTGCTTCTCA GAATCTAGGA GCTAAGCGAC CTGACCGTAT	2280
TGTTCAAGGT CTTCAATCG GCAGTCGTTT AAGTATATCC TGGGCAGTTT TTGTTGTAT	2340
TTTCTCTTT TTTGCCAGTC CAGCTTTGGT TTCCTTCTTG GCTAGTTCGA CAGATGGTTA	2400
CTTGATAGAA AATGGAAGTC TCTATCTGCA AATCAGTTCA ACCTTTTATC CCATTTTGAG	2460
CCTCTTGTG ATTTATCGCA ATTGCTTGCA GGGCTTGGG CAAAAGATCC TTCCTCTAGT	2520
TTCTAGCTTT ATTGAATAA TCGGAAAAAT CGTTTTGTG GTTTTGATTA TTCCTTGGC	2580
AGGATATAAG GGTGTTATCC TTTGTGAACC TCTTATCTGG GTTGCCATGA CAGTTCAACT	2640
GTACTTCTCA TTATCCGTC ATCCCTTGAT AAAAGAAGGC AAGGCAATCT TGGCAACCAA	2700
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TATATGATAT AATAAAGTAT AGTATTTATG AAAAGGACAT ATAGAGACTG TAAAAATATA	2880
CTTTTGAAAA TCTTTTATG CTGGGGTGT ATTGTAGATA GAATGCAGAC CTTGTCAGTC	2940
CTATTTACAG TGTCAAAATA GTGCGTTTG AAGTTCTATC TACAAGCCTA ATCGTGACTA	3000
AGATTGTCTT CTTTGTAAAG TAGAAATAA GGAGTTTCTG GTTCTGGATT GTAAAAATG	3060
AGTTGTTTA ATTGATAAGG AGTAGAATAT GGAAATTAAT GTGAGTAAAT TAAGAACAGA	3120

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TTTGCCCTCAA GTCGGCGTGC AACCATATAG GCAAGTACAC GCACACTCAA CTGGGAATCC	3180
GCATTCAACC GTACAGAATG AAGCGGATTA TCACTGGCGG AAAGACCCAG AATTAGGTTT	3240
TTTCTCGCAC ATTGTTGGGA ACGGTTGCAT CATGCAGGTA GGACCTGTG ATAATGGTGC	3300
CTGGGACGTT GGGGGCGGTT GGAATGCTGA GACCTATGCA GCGGTTGAAC TGATTGAAAG	3360
CCATTCAACC AAAGAAGAGT TCATGACGGA CTACCGCCTT TATATCGAAC TCTTACGCAA	3420
TCTAGCAGAT GAAGCAGGTT TGCCGAAAAC GCTTGATACA GGGAGTTTAG CTGGAATTAA	3480
AACGCACGAG TATTGCACGA ATAACCAACC AAACAACCAC TCAGACCACG TTGACCCCTTA	3540
TCCATATCTT GCTAAATGGG GCATTAGCCG TGAGCAGTTT AAGCATGATA TTGAGAACGG	3600
CTTGACGATT GAAACAGGCT GGCAGAAGAA TGACACTGGC TACTGGTACG TACATTCAGA	3660
CGGCTCTTAT CCAAAAGACA AGTTTGAGAA AATCAATGGC ACTTGGTACT ACTTTGACAG	3720
TTCAGGCTAT ATGCTTGCGAG ACCGCTGGAG GAAGCACACA GACGGCAACT GGTACTGGTT	3780
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CAACGAAGAA GGTGCCATGA AGACAGGCTG GGTCAAGTAC AAGGACACTT GGTACTACTT	3900
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TATTAGGTCT TGA AAAAGCT TAATAGTATG CGTTTCTTG TGGAGATATT TCCTTCAATT	4140
TTGCTACTAT ATTAAACAAA AATCAAAAAG CAACTAGAA AGTTATGCTC AAATAAAATC	4200
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TTGTTTGTG ATAATTTTTT TATTTAAAAA ATTATGACma GAGTGTGCTA TTCTTTTAT	4380
GAGAGGTGTA TGAATATGAT AAATGTATGT GATAAATGTA TGTGATGTTG GAAAAAGAAT	4440
AAAAGAACTT AGAATATCTT CAAATCTTAC TCAAGATAAG ATTGCTGAGT ATTTGTCTTT	4500
GAATCAAAGC ATGATTGCCA AAATGGAAAA AGGTGAAAGG AATATCACGA ATGGATTAA	4560
GTAATAAAGC TTCAAATCTT AGAAAAAAGT TGGGAGCTGA TGGTGAATCG CCGATAGATA	4620
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TGCCATTAGG AAGGTAAAGA TTTTCTTTAG CACATGGACT GTATCATCTT TATTATGATG	4800
AGGTGAAGAA GAGTTCAGTC AGTCTTATCT TGATTGGTGA AGGAGATGAA ACTGAAAGAA	4860
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TTGATGCAGA	AGAAATTAAA	AATATGGATA	TTAGTGTAT	AGAGACAGCT	TCAAGATTAG	5100
GCTATGATAC	AAGTTTATAT	CGTCCTTTGT	CAGAAAAGTAA	AAAAGAAATG	GCATTAGGAT	5160
AATATATTAA	TTCAACTGAA	CAACTTTTAG	AAAATAACAG	AATTTGCGAA	GGGAAGTATG	5220
AGGAACTGTT	ACTAGATGCT	TTCAGATATG	ATATTGTATA	TGGGCTAGAT	GAAGAGGGGG	5280
GAGTTGTCGT	TTGACTAGTC	GTGTATTTAT	TGATGCAGAT	TGTATTTTCTAG	TATTTTATATG	5340
GGTTGGCACT	GAACATCTTT	TAGAAAAGCT	CTATTTGGGT	AAAATTGTTA	TTCCACAAGA	5400
GGTGTATGAT	GAAATCAATA	TACCTACAAT	TCCCCATTTA	AAATCTAGGA	TAGATCAGTT	5460
GGTAGCTAAG	GGTTCAGCTG	AGATTGTGAG	CATAGACATT	GGAAGTGAAG	AATACGCATT	5520
ATATAGAGAT	TTAACAAGAA	ATCATGATAG	TAACAAGATT	ATTGGTAAGG	GAGAAGGGGC	5580
ATCTATTTCC	TTAGCGAAAA	AGCATAATGG	GATATTAGGA	AGTAATAACC	TAAGAGATGT	5640
TAAATCATAT	GTAGAAGAAT	TTTCTTTAGA	ATATATGACA	ACAGGAGATA	TACTGATTGA	5700
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TGCATAGTGG	ATGAGAGAAA	AGTTCTCCTT	GAAGTTTCC	TGAACTATCA	GTCGCATGTC	6000
AAACGATATG	TAGGCTAATG	TGAGAGGGGA	TAGCGAGTAG	TTTTTGGTTA	TTTTATCAAA	6060
AAACTTATAT	TTTATTATAC	CGAATGATAA	AATATAATAA	AAATGATAGA	ATAAGGAAAA	6120
AACATGAATG	TCAAAAAGAT	AATGTCAATT	TTTCAATCCT	TTTATGTTGA	TGTCAGTATT	6180
GAGGAACCTGA	CTTTGACTTT	ACCAATCAGT	TTTGTAAAAA	GGTTTGAGTA	TACTCAAATG	6240
ACTTTTCATA	AGGAATCATT	TTTATTGATT	AAAGAAAAGA	GAAGGGGGAG	TTTGAGTTCA	6300
TTTGTTACTC	AGGCTCGCAC	TATGGGTGAA	AAAGCCAATA	TGGATGTTGT	TTTGGTGTTT	6360
TCGAAGTTAT	CAGACAGTGA	AAAAAAGCAA	TTACTTCAAG	CTAGAGTTCC	GTTTGTAGAC	6420
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GTCCCTAAGG	AATTAACACC	TAGCGAACAA	TTAACGTGGA	TGCTCTTTT	ATTGACAAAA	6540
GGTCAAAAAG	TAGTAGATGT	TGATTTGCTT	TCACAAGTCA	CTGGACTTCC	AAACTCAACA	6600
ATTTATAGGT	GTTTGAGGAC	TTTTAAAGCT	TTATATTGGT	TAAACAAGCA	AAATAAGCTT	6660

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TACACATATA CGGTGTCAAA GAAAGAATTA TTCTTAAAT CCGTGTCTATG TTTATTTAAT	6720
CCCATCAAAA AACGGATTTT ATTGCCAGAT GCGCATATAA AGCAGATAAA ATCTGTTTCT	6780
AACCTTCTAT ATGGTGGTGC TTATGCTTTG TCGCATTCAA CTTTTTTAGC TGAAACGGAT	6840
GAAATATTA GCTATGTCAT ATGGCAGAGA AAATCAATC AGTTATCCTT GCCACTTTCT	6900
CAGCATGTTT TAAATGAAA GATGCTAGAG ATATGGAAAT ATCGTCCTTT TGTATCTGAG	6960
TTTTGGAATG ATTTTAAAAA TAATCATGAT AAACAATTG TAGATCCGAT TTCTCTTTAT	7020
TTGACCTTAA AAGATGATGA TGACCCACGT ATAGAGGAAG AGAGTGAAGC ACTAGAAAAT	7080
ATGATATTAC AGTATCTGGG AGAAGATGAT GCCAGCTAAT ACGAAAGTTA TTTTCAAGA	7140
AATGTTTGGC GATTTTCAGA ACTATTATGT TCTGATTGGG GGAAGTCTA CCTCTATCGT	7200
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TGAAGTAAAA AATAAGGAAT TTTATACTAC CTTGAATCAT TTTTAGAAT TGGGAGAGTA	7320
TCAAGGAAGT CAGAAAGATG AGAAAGCGCA GCTTTTTCGA TTTACAACAA CTAATCCTGA	7380
GTTTCTTCT ATGATTGAAC TATTTAGTAT CTTACCAGAA TATCCATTAA AGAAGGACGG	7440
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AGATTATTAT AATATATTGG TGCATGAAAA AGAAACCATT CAGGGGTATT CGGTATTGAG	7560
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ACATTTTATT GGATCAAAAT GAAATTTTGG AAATTCTGAA AAATTTTCTC GATGGTTAAA	7980
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CAAGACCTGA TATTATGCGT TTTTGTCTTT TCAAAACTTT TTGCCAGTC TCGTTTTTA	8160
TCCTCTAGTC ACTTGATTG TTTTCAAGTGG TTTTCTAGTA TAGTAGAATG AAACGAGAAC	8220
AGGACAAATT GATCAGGACA GTCAAATCGA TTTCTAACAA TGTTTTAGAA GCAGAAGTGT	8280
ACTATCTAG TTTCAATCTA CTATAGTTAA ATCTGCGGTC AAGTCTACTG GTGAATCTAT	8340
GATTGTAATA CTCTTCCAAA ATCTCATCAA CCACGTCAGT CTTGCCTTGC AGTCTGTATC	8400
TTACTGACCA AGCTAGTGAT GGATTTAGAA TAGGTGATTT GGAGCGTCCT ATTAGCTAGG	8460

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AAATGCTGCT CATAGTCCTT TGCTGAGGCT AGGGTGTTC AACATTCAAC ACTCAACTGG	8520
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GAAACGATTG TGTAATCAAA ATGTACCAAT ATTGTAGTAT TGGTACAGAA GATGTTGTGA	8640
ATGGATAAAT ATATCATAAC TGCTATCTCA AAAAGATTTC ATATGTCTGT GCATATATAA	8700
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TTCGTAATCC AAAGCGTTTA CGATGATTTC GATAGGTTGT TGAAAACATT TTAAACGTTT	8820
CTACTTTGGC AAAGATGTTT TCAACCTTGC TTCTCTCCTT AGATAGCGCA TGGTTATAGG	8880
CTTTATCTTC AGCTGTTAGC GGCTTGAGTT TGCTGGATTT ACGTGGAGTT TGTGCTTGAG	8940
GACATATCTT CATGAGCCCT TGATAACCAC TGTCAGCCAA GATTTTACCA GCTTGTCGGA	9000
TATTTCTGCA ACTCATTTTG AACAACTTCA TATCATGACA ATAGTTCACA GTGATATCCA	9060
AAGAAACAAT TCTCCCTTGA CTGTGACAA TCGCTTGAGC CTTCATAGCG TGAATTTCT	9120
TTTTACCAGA ATCATTGCTT AATTCTTTTT TTAGGGCGAT TGATTTTAC TTCCGTCGCA	9180
TCAATCATTA CCGTGCTCTC AGAACTAAGA GGAGTTCTTG AAATCGTAAC ACCACTTTGA	9240
ACAAGAGTTA CTTCAACCCA TTGGCTCCGA CGGATTAAGT TGCTTTCGTG AATACCAAAA	9300
TCAGCCGCAA TTTCTTCATA AGTGCGGTAT TCTAGGCTTA ATTTAGGTTT TCGTCCACCT	9360
TTTGCGTGTT TAAGTTGATA AGCTGTTTTT AATACAGCTA ACATCTCTTT AAAAGTCGTG	9420
CGCTGAACAC CAACAAGACG CTAAATCGT GTATCAGTTA ATTGTTTACT TGCTTCATAA	9480
TTTCGCAGGG AGTCTATTGA CTCCTTGGTA GGTGTCAATG TTTTPTTCAT CTATCCCGAG	9540
AATTATTTTC CCGCCATTG TATTTGCAAA TGCTGAGTAG GTTCCCAGA AAGACTCTGG	9600
AAGATTGTTT TTAGCTTTTT TGTATTCTAA ATCAACCCCT TCAAATTTTA AGTCCATATT	9660
TTTCCTTTAC ATCTGTTTTT TGTGGTTCTG GTATTTGPTC AAGTTGAGTG ATAATATAGC	9720
GAATTGAATT TCGAGAGTTT TTAATCAGTT AATTCTTTT TTAACCCACT TTAATTGCTT	9780
TTTTAACACG GGTAAAAAA GAAATTAAAG TGGGTTAATT TTTCTTGA	9828

(2) INFORMATION FOR SEQ ID NO: 42:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 3369 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 42:

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CCGCGAAAGA TATTTTGA CAAGAGTTG GACGTGAGGT CCGTGGCTAT AATAAGTAG	60
AAGTTGACGA GTTTTAGAC GATGTCATCA AGGACTATGA AACCTATGCT GCCTTGGTCA	120
AGTCACTTCG TCAGGAAAT GCGGATTTGA AGGAAGAATT AACTCGTAAA CCGAAACCTT	180
CACCAATTCA AGCAGAACCC CTTGAAGCGG CAATTACAAG TTCTATGACG AATTTTGATA	240
TTTTGAAACG CCTGAATAGA TTGGAAAAAG AAGTTTGTG TAAACAAAT TTAGATAACT	300
CAGATTTTGA AGTAGTTAT TGAGATGTGC AATTTTGGG TAATCGCGTG AGGAGAATTG	360
TTTCTCATGA GGAAAGTCCA TGCTAGCACA GGCTGTGATG CCTGTAGTGT TTGTGCTAGG	420
CGAAACCATA AGCCTAGGGA CGAGAAATCG TTACGGCAGT TGAATGGCT AAGTCCTTGG	480
ATAGGCCAGA GTAGGCTTGA AAGTGCCACA GTGACGGAGT CTTCTGGAA ACAGAGAGAG	540
TGGAACGCGG TAAACCCCTC AAGCTAGCAA CCCAAATTTT GGTCGGGGCA TGGAGTACGC	600
GGAAACGAAC GTAGTATTCT GACTGCTATC AGCTAGAGCT GTTAGTGGTA GACAGATGAT	660
TATCGAAGGA AGTGGTCTTA GTCACTTCTG GAACAAAACA TGGCTTATAG AAAATTGCAT	720
ATAGGTTGGG GCTGAGAAAT TTTCTCAACC TCATTTTGA AAGTGGACAT ATAGAAAGGT	780
CTTGCAAGAC TGTAACATGA AAAAGAAT TAATTTAAT GCAACTGTGG CAGCAGGGCT	840
TGAGGCTGTC GTTGGTCGTG AAGTGCAGG GTTGGGCTAC GATTGTCAGG TTGAAAATGG	900
ACGTGTTCTG TTTCAAGGAG ACGTGAGAGC TATTATCGAA ACCAACCTTT GGCTTCGGGC	960
AGCAGATCGT ATCAAAATTA TCGTAGGAAC GTTCCAGCT AAGACTTTG AAGAGCTATT	1020
TCAGGGAGTT TTCGCTTTGG ATTGGGAAAA TTATTTACCA CTTGGAGCTC GGTTCCTGAT	1080
TTCAAAGCT AAATGTGTTA AGTCCAACT TCACAATGAG CCCAGTGTTC AGGCTATTTT	1140
TAAGAAAGCT GTTGTCAAGA AATTGCAGAA ACACTATGCT CGCCCAGAAG GGGTTCCTCT	1200
GATGGAGAAT GGCCAGAGT TTAAGATTGA GGTCTCTATT CTCAAAGATG TGGCAACTGT	1260
CATGATTGAT ACGACCGGT CTAGCCTCTT TAAACGTGGT TATCGTACCG AAAAAGGTGG	1320
CGCTCCTATC AAGGAAAATA TGGCAGCAGC CATTTTACAA CTTTCTAACT GGTATCCAGA	1380
CAAGCCTTTG ATTGATCCGA CCTGTGGTTC GGGGACTTTC TGTATTGAGG CAGTTATGAT	1440
TGCTAGAAAG ATGGCGCCAG GTCTTCGTCG CTCTTTTGCA TTTGAGGAAT GGAAGTGGAT	1500
CAGCGATCGC TTGATTCAAG AAGTGCAC AGAAGCGGCT AAAAAAGTAG ACCGTGAGCT	1560
TGAGCTGGAT ATCATGGGCT GTGATATTGA TGCTCGCATG GTGGAATTG CTAAGGCCAA	1620
TGCTCAGGTA GCTGGTGTG CAGGAGACAT TACTTTTAAG CAGATCGCG TGCAGGATT	1680
ACGTTCGAT AAAATCAATG GAGTAATCAT TTCCAATCCG CCTTATGGTG AACGTTGTC	1740
AGATGATGCA GGGGTGACCA AGCTCTATGC TGAGATGGG CAAGTATTTG CACCGCTGAA	1800

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AACTTGGAGC AAATTTATCC TGAAGCTTTT GAAAGCAAGT ATGGTAGCCA	1860
AGCAGATAAG AAGCGTAAGT TATACAACGG AACCTTGAAA GTGGATCTAT ATCAATATTT	1920
TGGTCAGCGT GTCAACGGC AAGAGGTAAA ATAGAAAGGG ATACTCATGA GTAAAAAAG	1980
ACGAAATCGT CATAAAAAAG AAGGTCAAGA ACCGCAATTT GATTTTGATG AAGCAAAAGA	2040
GCTAACAGTT GGTCAAGCTA TTCGTAAAAA TGAAGAAGTG GAATCAGGAG TCTTGCTGA	2100
GGATTCCATT TTGGACAAGT ATGTTAAGCA ACACAGAGAT GAAATTGAGG CGGATAAGTT	2160
TGCGACTCGT CAATACAAA AAGAGGAGTT CGTTGAACT CAGAGTCTGG ATGATTTAAT	2220
TCAAGAGATG CGTGAGGCTG TAGAGAAGTC AGAAGCTTCT TCGGAGGAAG TTCCATCTTC	2280
TGAAGACATC TTAATACCCT TGCCTCTGGA CGATGAGGAG CAAGGCTTGG ATCCTCTATT	2340
GCTAGATGAT GAAATCCAA CAGAAATGAC TGAAGAAGTG GAAGAGGAGC AAAACCTTTC	2400
TCGTCTGGAT CAAGAGGACT CAGAAAAGAA AAGTAAAAA GGCTTTATTT TGACCGTTT	2460
GGCGCTGTA TCAGTAATTA TTTGTGTCAG TGCTTATTAT GTCTACCGTC AAGTGGCTCG	2520
TTGCACTAAG GAAATTGAAA CTTCTCAATC AACTACAGCC AATCAATCGG ATGTGGATGA	2580
TTTAAATACA CTTTATGACG CCTTTTACAC AGATAGCAAT AAAACGGCTT TGAAAAATAG	2640
CCAGTTTGAT AAAGTGAATC AACTCAAGAC TTTACTTGAT AAGCTGGAAG GTAGTCGTGA	2700
ACATACGCTT GCCAAATCTA AATATGATAG TCTAGCAACG CAAATCAAGG CTATTCAAGA	2760
TGTCATGCT CAATTTGAGA AACCAGCTAT TGTGGATGGT GTGTTGGATA CCAATGCCAA	2820
AGCCAAATCG GATGCTAAAT TTACGGATAT TAAAACTGGA AATACGGAGC TTGATAAAGT	2880
GCTAGATAAG GCTATCAGTC TTGGTAAGAG CCAGCAAACA AGTACTTCTA GCTCAAGTTC	2940
AAGTCAAACT AGCAGCTCAA GTTCAAGTCA AGCAAGTTCA AATACGACTA GTGAGCCAAA	3000
ACCAAGTAGT TCAATGAGA CTAGAAGTAG TCGCAGTGAA GTCAATATGG GTCTCTCGAG	3060
TGCAGGGGTT GCTGTTCAAA GAAGTGCCAG TCGTGTGCC TATAATCAGT CTGCTATTGA	3120
TGATAGTAAT AACTCTGCCT GGGATTTTGC GGATGGTGTC TTGGAACAAA TTCTAGCGAC	3180
TTACAGTTCA CGTGGCTATA TCACTGGAGA CCAATATATC CTTGAACGTG TCAATATCGT	3240
TAACGGCAAT GGTATTACA ACCTCTACAA GCCAGATGGA ACCTATCTCT TTACCCTTAA	3300
CTGTAAGACA GGCTACTTTG TCGGAAATGG CGCTGGTCAT GCGGATGACT TAGATTACTA	3360
AGCAGTCGG	3369

(2) INFORMATION FOR SEQ ID NO: 43:

- (i) SEQUENCE CHARACTERISTICS:  
 (A) LENGTH: 9713 base pairs

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(B) TYPE: nucleic acid  
(C) STRANDEDNESS: double  
(D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 43:

AAGTTTACAA TTTAAATGAA TTAACAATTT TCCCAACTAA AAGCACTCCA GTTACCGCAA	60
CGTTTGTA CT GAATGTACTA AATCGCATTC CATCAACTTC ATCTGTTTCG TCAACTTGAA	120
CAGATACTAA TTGAAGATTT AATACTTCTG CTGCCATAGC TAGCTCCTCC TATTTAAATT	180
TTTGGGATTA AGTACTTTAT CCACCCTCAT ATACTCTCTC CACCAGTAAA ATGCAAGCAA	240
TGATACAAAA TAGATTTAAC TATTTTATAT AGCGAAAACT TACAAATTTT TAAGAAATAA	300
TTTTTGCATT CTTAAAGATA AAATAGGAAC TTTTAGTAAT AAATATPAAA ATAAATAAAA	360
TAATAGATAC TATAAAATTT GGAAGTATTA ACCCCAAAAG ATTCATATCA TCTATTAAAA	420
TATCCTCTAA AGAGTAGTAT ATTAAAGCCA TAATTTTAAT GTTAAGTAAA AATGCAATTA	480
ATGAAGTAAC AAATGTCAA AATATAGCCT CACCAACTTT AATCTTAACC ATCTGGTAAT	540
TAGAAGTTC TAAAAATTCA AATTGCTGAA TCTCAATCCT TTCTTGATGC GATGACAAAA	600
ATGCAATTGA AATAATATTT GCAAGTACTA TCAAAATTGG TGCTCCTACA TAGACAATAA	660
ATGCTACTTT TAGCTCTAAA TCACTGTCAT CTTGAAATTG AGATAGTATA TTCTGAGAAA	720
TCATTTGAAA ACTAGAAATT AGTAATATAG CTCCTGTAAT TGCAGCACTG ATAGATTTTA	780
TATAAGACTT ACAATATAGT AAATCCACT TCGAAACAAT GAACATAAAA TTATTTCTAA	840
ATATAATTAT AGAAAGTAGT TTGATAAAAC ATGACTGTAT AAAAGGAGAT AATTGATAAA	900
TAATCACAAT ATCTAAGATT ACAATATTGA ATATTATCTG GGCCTTCGCT AAAATTGTGC	960
TATCTTGGA AATTTGTTGC AAAGAAAGCA ACCAGATAAC ACTAAAACCA GCCAATAGCA	1020
GTATTTCTTT TACTATTGAA AGAACATGCC TTATTTTAGA ACTCTTCCTA TTTCTAATCT	1080
TCTTGAACGT ATAAAAGCAA CCACTTAGAA AGGCTAAAAA TGAAATCAAC ACTACTGTAA	1140
TGATACATCC AACAGCACTC GTTTGAAATT GGATATCAGG TAATATATTT TCCCCGAAAA	1200
AGTATTGTAA AAAATAATAA TAATTTGACG TAACAAATAT AGAGCATAGA TATGCAATAA	1260
AACATAAAT CGAGGAAATG ATAAAAATCT GTCCCCCAC AAGAAATGAT AGTTGAAGGC	1320
GACTTGCTCC CAACACCTCC AGAAGTTCGT AATCATCTCT AAAAAATTCA ACCAACATAT	1380
TTATTATGTT AGAGAGCACA AAGAATAATG TTA CTCTCC GAATACTATC GGAACATAA	1440
AAATTGGTTT AGGATCTGGA AGTCCGACAA ATACTTGCGA ATTATTCTCA ACATTAATTA	1500
CCCCATTAAC AGCCAATCCC ATA ACTAAAC TCGAAACAAA AATTACTGGT GAAACGCCTA	1560

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ACCATGTGTTT CTTATTATGT AAAAATTGAT AGTAACTAA TCTGAGCATC TCTATTCCCTC	1620
CGTAGTTGAT TGTACCTCTA AGATTTTATA CAACTCTTCC CCGCTAGGTC TATGAAGTTC	1680
TTTGAAAAAT TTTCCATCTT TCAATATTAA TGCACGATCA GTTTTCGAGG CCAATTCTAT	1740
ATCGTGCGTT ACCATAATTA CACACTTACC CGCCCCTACT AACTCTCTCA ATAATTCAAA	1800
AATTACTTCA CGAGAAACGC TGTCTAAAGC CCCAGTTGGC TCATCAGCAA ATATTATATC	1860
ACTATCAGCA ATAACCGCTC TAGCTATAGC AACCTTCTGT TGTTCTCCAC CAGACAGAGT	1920
TCCAACAAAA TCGTTTAAGC CAGCATTAAA CTTCAATTCTT TTGAGTAAGT TTTCTACATT	1980
TTTAATAGTT AATTTTTTTT GTGATAATCG CAAAGGAAGT GCTATATTTT CTATTACCGG	2040
CAGGGAAGGT ATTAAATTGT ATGCTTGAAG TATAAAGAT ACTTCGTTAC GTCTTATACT	2100
TGACAAATTT GCATTTCTGA TTTTATAGG GTTGATTCCA TTAAAATTA CTTCCCACT	2160
TGTTGGTTCA AGCAAACCTAG AAATACATTT TAATAAAGTT GACTTTCAG AACCACTAAT	2220
TCCTAGAATA CTTATAAATT CTCCTCTCGA AGCAGAAAGA GAAACATTTT TCAGCACTTG	2280
CAACGTTTTA TTATTTCCTA GTAAAAATTG ATGATACAGC CCTTTCACCT TTAATATATA	2340
ATCTTTATCC ATATTCTTGC CTCCAATCAC TTAATTTTGA AAAGTGTCC ATTTTCCAAT	2400
TTATATATAT CAGTGTATCT CTTGTCAATT AAGTCATAAT GATGTGAAAC TTCAATAAAT	2460
GAAATACCTA AATTGAACAG AATATCATGT ATGGAATTG AATTATCATT ATCTAAATTA	2520
GCTGATATTT CGTCAAATAA GTACACTTTA TTATTTCCTA TCAGAGCTCT AGCTAAAGCT	2580
ATTTTTTGTT TTTGACCTCC AGACAAATTA CTACCATTTT CACCACATTG ATAATTTAGT	2640
ATATCTATCT TTTCTAATTC TTCATATAGA TTTACCTTTT TTAACACCTC AATTATCTGA	2700
TCATCTGAAA AATATTCAAT TTGAAATAAA GTTACGTTCT CACGAATAGT AGTGTCAAAA	2760
ATATATGGTG TCTGATCAAC TGTGGGTATT GAATCTGAAC TCTTTTCCC ATGTGATAAC	2820
AAATTTACAT AACCTTTTGG TGGCTTTAAA GAACCATTA TTAATTTTAA AATCGTTGTT	2880
TTCCCACTAC CAGAAGTCC TGTTAATAAT ACCCTAAATG GTGACTTAAA TGAGAAGTCA	2940
ATACTTAATT TATTTTCTGG TGAATAGAA TATACAACAT CTTTCATGTG TATCTCATCT	3000
ATTGATGAAG TATACAGTCC GTTATTATCA TGTTCAGCGT CTATAAAAT CTTCTCTCCA	3060
CTTAAGTATT TAAAAACGG TTTCCTTAAA TCTTTGGTTG TATTTATCTT ATTTAATGAA	3120
TAGGCAATTG ATTGTATCGG CCCTAAACT TTATCGTTG CTAAGAAAAT ACCTATCAGT	3180
TCACTAAAAG AAAGGCTTTT ATGATAAATT ACAAATAAC ATCCTACAAC CAAGGGAAT	3240
AGAAAGCAAA AACCTGAAAT TAGTACTGCA ACCAATTTTG AAAGAACCTC TGATCGTTTC	3300

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AAATTAAAAG TAGAATCTTC TAGTTTATCC AACTTTTAT CCGACAACT AATTATTTCT	3360
TTAGTAACAG AATAAGATTT TAATGTCTTA AAACCATTAA AAATTTCTTT TATTATGTGA	3420
GTATACTCTG CATTGCTGTT AGAGTACTCA TTAGCTGAAT TAGACAACAT CTTCTTCATA	3480
AAGACAGGTA CTATAATCGG CAATGCTGAT AATACAATAA ATATTATTGA nACTAGGAAG	3540
TTTAAATAAA GCATAAACT TAGAGAGACG ATGAACAACA ATATTGAAGA AATTATTTCA	3600
AAAATTTGTC TAAATAGTT TTCTTCGATT AATCTCAAAT CATTTGACAA AACTGAAATA	3660
ATAGATGAGT AATCTTTAAC CATTTCAGAA GAAAGATACT GTTCTCTAAA ATATCCTTGT	3720
TTAATTTTTA CATTTATATC TTTAGTTATT GATGCTTCCG TTACTTCTAA ATAGTAATTT	3780
GATATATAGA TTGCTGACCA ACCCAGAATA CTTATAGCAC CAAATCTTAG AACGTCAGAA	3840
AATGAGGAAG TCTGATTTAA ACTACCTGCA TATACAATAA TTCCTGAGAG CAAGACACCA	3900
TTAAACGAAG ATAGAAATAT TAAATCCCC ATTAATATAA GTTTAGTCTT TTTTATAAAT	3960
TTTAAATAAT TCATAAGTTA TTCCTTCCCA CTTCTTCAAA GAAATAATTT AAAGTATCAA	4020
TCATTAAGAG AACATCTGAT GGAGTAAAAC CTCCATGACC AGCTGCTTTG TTTAAATACA	4080
ACAAACTTTT AACTCCAATA GAATTTAATT TCTTTGACCA CTCTATCACT TCGTTATTAT	4140
TAATATATGG GTCTTTCTCA CCCAAATAT TAACTATAAC AGTATTTGAG TCTCGTGCCT	4200
TTTCAATATT TTGCATAGGC GAATATGACT TTATATAAGC CTTTACTTCA GGGTCTCTAA	4260
TATCTCCCA CTCTGCTATT TCGGTCTTAG AAAGAGGATC ATTTGGATTC TGAAGTGAT	4320
CATAAGGATT TATAAATGGC GAAATAAGA GAATGCTTTG CAATAAATTT TTTTCCTCGT	4380
TCAACACCGC ACCAGCAATT ATCCACCTG CACTAGAAGT TATTAAACCT AATCGCTTAC	4440
TGTCAATTAC ATCATTTTCC CTTAAATAAT TTACTCCCTC AATAAAATCT CTGATAGAAT	4500
TCCATTTGTT TAACGCCTTT CTGAGCGAT ACCATTCAAC ACCCAAATAG CCTCCACCTC	4560
TTACATGAAC TATAGCATAA ATAAAACCTG CATCTATTAT AGATAACATA ATTCATCTA	4620
AATCAGAATT ATCATTTCTA CCATAAGCCC CATAGACACT TAGAATACAT TTTTCTTCTC	4680
TTGGGAGCTC ATCCGTATCT TCACTTTTCC AAAATAAAGA AATCGGTATG CTTACATCAT	4740
AACTGTCTTT TTTAGTCCAA ATCACCTTAG AAAATATTT AGTATTATTC GATTTTATGA	4800
TGGGTCTTTC AAATTCAGTT TTTAATGTAT TTTCTATTAA ATCAAACTA AGTATTTTTT	4860
CGTAAAAAGT TCTCCTCTCT AAAACAGAA GAACACGATC AGAAAAAGAA TTTTCATAAA	4920
GTGTTGTCTT TTCATCAAAT GTTATCTTAT TAACACTCAA CTCCCTCAAA CTATTATTTT	4980
TAAATGTAGC AAGATAAAG ACGGAATTCG CTGCGTTTGA ACAGTCTAAA AGGATATAAC	5040
GTCCTATACA GTGAACTCTT CTAGCCCTAT CTTGATATGG TATAGTAATA GAAACTCTGT	5100



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CTCCCGAAGA AGTTTCCCTT AGAATTAGTT GATCTTTCTT TTCTTCAGTT GAAGAGAGCC	5160
CAAGAAAGTA CTGTGCTTTT TCTGTACTAA ATAGAGCGAT ATCTCTAGGT GTTGGGGCTA	5220
CCGTTTCTGT GTAAGAGTGT CTAACAAAAC CCGTCCGGTC GAAACTGTAT AGAAAAATCC	5280
TGCCTTTCTG AAAGTCTACT GACTTTACAA AACAATTATT GCTATCAATG TGGACTATTT	5340
TTAATCGAAA AGAGCATTCG TTTTCTTCAA ACAGTTCCTC TTCTGTAAAG CTATCAAAAG	5400
ATTTATAGAA TAACTTACTT GGCTCCCGT ACTCTTTGGA GCGAGTATAC ATAACACCGA	5460
ATTTACCCAA ATAGAACGAA CTTTCTACTG AAATATCTTC AATGATAAAT AACTCTTCCA	5520
TAGTATATTT TTTTATTCCA ATTAAATTAG TCGTACGCAG TGAGGATACA ACCAAAATA	5580
TATAACTCTC ATCAGATGAA ATCCTAACAT CCTGTAAGAT ACTATCATCT GGCAAAGTAT	5640
ATTTTTCAC ATCAAAGACA ATTTAAGTG AATTTGAATT GTCTAAACTG GAAGAACTAA	5700
CCTTAGGAAT CCAGTCATTA TCTTCGACAT ACCATTCCTT TATTACACCA GTATTGGGTA	5760
TACTCCAATT ATCAAATTGG TACCAATATC GCCCTCTCCT AAATATCAAA GAATTCCATT	5820
TTTTTAATTC CTGAAATGAT GAAGAGATAG ACCTCTTATA GTGTGTTTTT TCCTGTATTG	5880
TATTTAAAAA TATTTTATTA CTCTGATTCA CAAGTATGAC CCCTTAATAA TGGTATCTAA	5940
ATATTATATT TGAGGAAGAA TCGTCAATTT ATTATCCATT ATTGATACCA ATCCAATTGC	6000
AACACCCGCA AATCCCGAAG CAATATCTGT TGTATCTTTT AAACCATTAT CTCCCGCAAT	6060
AACAAATCCT TCTTCAATTA CACACAAATA TCTATAAAGT TGTTCATTA ATTTCTTTTG	6120
TCCTGAAAAG TTATCATCGA TATCACTATA TATATTATTA GCAACTTCAA GACCACAAAA	6180
TCCGTAAAT AAACCTGGTA ATACACAAAA AACTACATCA GTTGCCCTCT CTAAAGAAGT	6240
TAAATATTTT AAGTATTTGC TTGACAAGAT TTCTTTATTT CTATTAATAA GTAAAAGCAG	6300
GCCAGCACTT CCAGTTGCTA GATATGGTAG TAATCTATGA CCTTGGCTGT ACTGCAATGA	6360
ATTATTACTA TCTACTTTAT AAGCAACTAA TTCTTTATCT ACAGCCAATT CTAGACCATT	6420
TTTATAGATA CTTTCACCG TTAATTTATA AGCTTCACCG AAGAGCCAAG CTACCCCTGC	6480
GTGACCATAT AGTAATCCAC CAAAATTCTC ATAAGGATCG TTAATCTGAA CATCACTAGC	6540
GCCAATTTA CAAAAGTTT CTGGAATTTT TATATAATTT AAAGTATATT CTCTAAGCCT	6600
AATTAGTATT TCTTCTCTTA GTTTATTATC AATTCCCCCT TTAATAAGAA AATACAGTCC	6660
AACCAAGTAA ATTCCAGCCT GCCCACTATA TAAATTTTTA TTTTGTGAAT TCTCAAATAT	6720
CTCTATAAAA TGAGTTGTAA AAAGTTCAAC TGCCCGATCT ATCTCCCAA ATTCATAAAT	6780
GAGCCAGATT GTACCAATTT TACCATCAAA AAGACCAGAA AGGGACGATT TCTTAAATTT	6840

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ATTTACTGCC TCATTAATAA CCTGTGTTTCG AATCTCATAA TAGTCATCAA ACTTGAAATT	6900
TTTTACTTTC TTAGCTAGTT GTTGATAACT CCAAAGGATA GCTAAATCTG AAAACGCAAT	6960
TCCTTGATTA AAATTCAGAC CATAATAATG AACTGGGAAG AATCTTGATT GAAATTCCTT	7020
ACGCCACTGT CCATAAGTTA GCGTAAACCC TCTCAATAAT TTTATAATAA AATCTTGAT	7080
ATCTTGCTCA CTCTCGATAG TTCTAATCTC ATGCATGGGT TTAAAACTT TTTCTCTGGA	7140
AATATTCTCA ATCTGTGGAC ATTTAGAATC TAGATATGAC AATAAACTTT CTACATAATC	7200
TATATGTTCT CTGTGATAAC CCAAAGACTC AAATAGTTTT TTCTCTCTA TCCTGGTTTG	7260
ACTTACATAG TTGTATGTCA AATCCGATGT AGTTACTAGT GGCATGTATA AATAATGAGC	7320
TATTTGTCTA ATACCATACC AATCTATCTC ACTGGGAAGT GTTCTCTGCC ATGCTCTAAA	7380
ACCAGGGGCT GCAACTTTAT GTACAACCTT TTCATCATTT GAAAGACAG CCTGTTCCTA	7440
GTCTATTATA CTAATCTCAT CTTATCCTT AACCAAGATA TTCTCTAAAT GTAAATCTTG	7500
ATGATATACA TTTTCAGAAT GAAACTTATT CGTTAAATCG ATGAGTTTTT CTAATATCTT	7560
TGAACTCTC AATAGATAAT CTTGGTCTT ATCAACAACT TCATATAAAG GAAATTTATT	7620
GGTAACCCAT CTATTTAGTG GAACGCCCTT CATATGTTCA ATTCTAAGA AGGTGTGCTC	7680
CCAGATCTTA CCGTGCCAGT ATATTTTAGG CGTCTCACTC CATTCAATTA GAATTTTAG	7740
TGCTTTGCAC TCCGAAGCTA ATTTCTCTGA AGAATAAGTA CCATCAAATC CTAGACCTGT	7800
ATACGGTCTA GCCTCTTTTA AAATTATTTT TTTCCCATCT TCTTTTAGCC TAGCATTATA	7860
TATCCCACCA CTGTTTGAAA ATCTAATTGC ATTATCTATA ATAAAGGGAA AGTCTCCCTG	7920
TTTTTTATCT TTCTTGTCAA GCCATTTATT CAAAAGTCA GGGGGCACTA TACCTTTTGG	7980
AATTTTAAAT ACTGGTAAAC GTTCATCTTT AACAACTTCA TCGCCAACAA TTAATTCATC	8040
AATAGCAACC TTCTTTTCAT CATCCCTTGA CGGCCTAAAC ACACCATACC TCAGATATAT	8100
TGGTGCCTCA TCCCAACGTT TATCGCTTAA AATATATGGC CCATTATATT GCTTTAAGGC	8160
ACTTCTAAC CTTTGCAAAA CCGACTCTAA TTCATTTTGA TTTGGATAAC ATGTAATAAA	8220
TTTACCAGAA AATCCTCGAC TAACCAATTT CCGTTTCGC ATGATAAATT TGTCTCTGT	8280
ACTAAGATGT TTAATGGAA TTCGCATTTT ATGGCAAAT TTTGCTACAT CTGTAAACAA	8340
TTCATGTGAA CTGTTATACT CTGAACTAAT GTGTATTTTC CACCCTTGTC TTTCAACAAA	8400
TTTTCCAATA GGTATTGAT AAACCACTC ATCATTATTC ATTACTTCGT GCCAATTAAA	8460
AGGCAGACTT ACTTGGTACT TTATGCTAGT ATCTGTACTA TAATCATTAT TAGTGAAAAA	8520
GAAAGGATGC TCCAAATTGA AATTATAATC CATAACAAA TCTCCAAGAA ATTTTATCAA	8580
ACTTAATATA TCTATAGCTA GACAGACTTA TTAAATAAA AAGGGAGAAT CCTTTGGATT	8640

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CTCCCCATAT AAGCACTAAC ATTCCAACGT GCACATATTG GAACGACATC CATAACTCCA	8700
GAGAATCTCT AAAGTTTACA ATTTAAATGA ATTAACAATT TTCCCAACTA AAAGCACTCC	8760
AGTTACCGCA ACGATTTGTA CTGAATGTAC TAAATCGCAT TCCATCAACT TCATCTGTTT	8820
CGTCAACTTG AACAGATACT AATTGAAGAT TTAATACTTC TTCTGCCATA GCTAGCTCCT	8880
CCTATTTAAA TTTTGGGAT TAAGTACTTT ATCCACCCTC ATTATACTCT CTCCACCAGT	8940
AAAATGCAAG CAATTATACA ATGTTGTCAC ATAGAAAATA ATGTTTCCGT AACTTTTCAA	9000
AGTAACTTCC ATCTCTCTCC CAAACTGGA AGTTAGTTTT AGAAGTTACC TAAAAATCAG	9060
GTCACCTATT TTA AAAAAGC AGCAAACTAT AAAGTAGTAG GTTCCACACC AAATGTAGTC	9120
CCATACTGCC CCATAAGTCA GATTTATAGC GCACCATAACC TAAAAACATC CCAAGTGAAA	9180
CATACAAACA CCAAGCTAGA ATGGTTCCTG TATGATGTGC TAAGGCAAAT AAAACACTTG	9240
TCAAAGCAAC TCTGATATCT AATTTTCTGA CCAAATTCCTA TAAAATTTCT CGATACAGAA	9300
ATTCTTCAAC CATACTCGCA TTGATTAGA ACAATAAAAA TGAAAACCAA GGAATTTGAT	9360
GTTGAAGGCC AATTAAGTTT GCTTGATTCG TGCTTCCTTG AGCATGAATC AGACTAAAAC	9420
ATAGACTTAT AATCAGTAGG CTAACAAATT CAACACCAAG CCATTTTCATC CTAGATTTCA	9480
TATTGACCTT ATGCGCTTGT TTGCGTTGGC CATACATCCA TAAAAAAGAA ATGAGTGACG	9540
AACCATAGAG AATCTGTAGT ATAGTTTACT CACCGATACA AAGAAATTTT AATAAGTATA	9600
GAGrTACCAA TAsGACATTT ACTTGTGGA ATATATAAAC TGGAATTATT CTTTTCATAG	9660
TTACCTCCGA AATAAATCTT CATAATCTAA ATCTAATACC TGCACAATCC TTT	9713

## (2) INFORMATION FOR SEQ ID NO: 44:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 8657 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO: 44:

AAAGAAATTG TCAGAGAGTG GCTAGATGAA GTAGCAGAGC GGGCTAAGGA CTATCCAGAG	60
TGGGTGGATG TTTTCGAGCG TTGCTACACC GATACCTTGG ACAATACGGT TGAAATCTTA	120
GAAGATGGTT CAACTTTTGT CTGACTGGG GATATTCCTG CCATGTGGCT TCGAGATTCG	180
ACAGCCCAAC TCAGACCCTA CCTTCATGTA GCTAAAAGAG ATGCCCTCCT GCGTCAGACC	240
ATTGCAAGTT TGGTCAAACG TCAGATGACC TTGGTACTCA AGGATCCCTA TGCTAACTCC	300

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TTCAACATTG AGGAGAACTG GAAAGGGCAC CACGAGACTG ACCACACAGA CCTTAACGGC	360		
TGGATCTGGG AGCGCAAGTA TGAGGTGGAT TCGCTTTGCT ATCCTTTGCA GTTGGCTTAT	420		
CTCCTCTGGA AAGAGACTGG CGAGACTAGT CAGTTTGATG AGATTTTGT CGCAGCGACT	480		
AAGGAAATTC TCCATCTGTG GACGGTGGAA CAAGACCACA AGAACTCTCC TTATCGTTTT	540		
GTCCGAGATA CGGACCGTAA GGAAGACACC TTGGTAAATG ATGGCTTTGG ACCTGACTTT	600		
GCAGTGACAG GTATGACTTG GTCAGCTTTT CGTCCGAGTG ATGACTGTTG CCAGTATAGT	660		
TACTTGATTC CGTCAAATAT GTTTGCTGTA GTAGTCTTGG GTTATGTGCA AGAAATCTTC	720		
GCAGCATTAAC ACCTAGCTGA TAGCCAGAGT GTTATTGCTG ATGCCAAGCG TCTTCAGGAT	780		
GAAATCCAAG AAGGAATCAA AAACCTACGCT TACACCACCA ACAGCAAGGG CGAAAAGATT	840		
TACGCTTTTG AAGTGGATGG CCTAGGAAAT GCCAGCATCA TGGATGATCC AAATGTACCA	900		
AGTCTACTAG CTGCGCCCTA TCTGGGCTAC TGTTCGGTCG ATGATGAAGT GTATCAAGCT	960		
ACTCGTCGTA CCATTTTGAG CTCTGAAAAT CCATACTTCT ACCAAGGAGA ATACGCAAGC	1020		
GGTCTCGGCA GTTCTCATAC CTTCTATCGC TATATCTGGC CAATCGCCCT TTCTATCCAA	1080		
GGCTTGACAA CAAGAGATAA GGCAGAGAAA AAATTCCTGC TGGATCAGCT GGTGCGCTGC	1140		
GATGGTGGTA CAGGTGTCAT GCACGAAAGC TTTCATGTAG ATGATCCGAC CCTCTACTCT	1200		
CGTGAATGGT TCTCCTGGGC TAACATGATG TTCTGTGAGT TGGTCTTGGA TTACTTGGAT	1260		
ATTCGCTAAG GGGCTCGCTT TAGCTCAACC GATTCTTATC AGAATCACAA GTTTACATT	1320		
AAAACGTAA AATTTAAAT TAGAATGAGG TTTTACTTCA TGGAAAATGT TGTGTACAT	1380		
ATTATCTCAC ATAGTCACTG GGATCGTGAG TGGTACTTGC CTTTGAAG CCATCGTATG	1440		
CAGTTGGTGG AATTGTTGA CAATCTCTT GATCTCTTG AAAATGACCC TGAGTTCAAG	1500		
AGTTTCCACT TGGATGGACA AACTATTGTC CTTGATGACT ACTTACAAAT TCGCCCTGAA	1560		
AATCGCGACA AGGTCCAACG CTACATTGAC GAGGGCAAAC TTAAAATTGG TCCCTTTTAC	1620		
ATCTTGCAAG ATGACTACTT GATCTCCAGT GAAGCCAATG TCCGCAATAC CTTGATTGGT	1680		
CAACAAGAAG CTGCCAAATG GGGTAAATCA ACCCAGATTG GCTACTTTCC AGATACCTTT	1740		
GGAAATATGG GACAAGCGCC TCAAATCTT CAAAAATCAG GCATTACGT GCGGCGCTTT	1800		
GGTCGTGGTG TGAAGCCGAT TGGATTGAC AACCAAGTCC TTGAAGATGA GCAGTTTACG	1860		
TCTCAGTTTT CAGAAATGTA CTGGCAGGGT GTGGATGGTA GTCGTGTTTT AGGTATTCTC	1920		
TTTGCCAACT GGTACAGTAA CGGGAATGAA ATTCCAGTTG ACAAAGATGA GGCCTTGACC	1980		
TTCTGGAAC AAAAATTGTC AGATGTGCGT GCCTACGCTT CGACCAACCA ATGGTTGATG	2040		
ATGAACGGCT GTGACCACCA GCCTGTACAG AAAAATCTGA GCGAAGCCAT TCGTGTGGCA	2100		

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AATGAACTCT TCCCGGATGT AATCTTTGTT CATAGTTCTT TTGATGAATA TGTTCAGCT	2160
GTAGAAGGTG CGCTTCCTGA ACACTTATCA ACTGTTACAG GCGAGTTGAC CAGTCAGGAA	2220
ACAGATGGCT GGTACACACT TGCCAACACT TCTTCATCCC GCATTTACCT AAAACAAGCC	2280
TTCCAAGAAA ATAGCAACCT CCTAGAGCAA GTGGTAGAAC CCTTGACTAT TATCACTGGT	2340
GGACACAACC ACAAGGACCA GTTGACCTAT GCTTGGA AAA CACTTTTGCA GAATGCGCCA	2400
CATGATAGTA TCTGTGGCTG TAGCGTGGAC GAAGTTCACC GCGAGATGGA AACGCGTTT	2460
GCCAAGGTCA ACCAAGTAGG AAACCTTGTT AAAAGTAACT TGCTCAACGA GTGGAAGGGT	2520
AAAATTGCTA CGGATAAGGC TCAAAGTGAC TATCTCTTTA CTGTCATTAA CACAGGCTTG	2580
CATGATAAGG TCGATACTGT CAGCACAGTG ATTGATGTGG CGACTTGTGA TTTCAAGGAA	2640
TTGCACCCAA CAGAAGGCTA CAAAAAGATG GCTGCTCTTA TCTTGCCAAG TTACCGTGTG	2700
GAGGACTTGG ATGGTCGTCC TGTAGAGGCT ACAATCGAAG ACCTCGGAGC TAATTTTGAG	2760
TATAATTTAC CAAAAGACAA GTTCCGCCAA GCTCGTATTG CTCGTCAAGT GCGCGTGACC	2820
ATTCCAGTTC ACCTAGCGCC GCTTCTTGG ACAACCTTCC AATTGCTGGA AGGAAAACAA	2880
GAACACCGTG AGGGTATTTA CCAAAACGGA GTGATTGATA CACCATTCGT AACGGTGAGT	2940
GTGGATGACA ACATCACAGT CTATGACAAG ACAACTCAGC AAGCCTATGA AGACTTTATC	3000
CGCTTTGAAG ACCGTGGGGA CATCGGAAAC GAGTATATCT ATTTCCAACC AAAAGGAACA	3060
GAGCCAATCT TTGCAGAGCT TAAGGGCCAC GAGGTCTTGG AAAACACAGC TTGCTATGCT	3120
AAAATCTTGC TCAAACATGA ATTGACCGTG CCTGTCAAGT CGGATGAAAA GCTAGAAGAA	3180
GAGCAACAAG GTATCATCGA GTTTATGAAG CGTGAGGCTG GACGGTCAGA AGAATTGACA	3240
AACATTCCTC TGGAACTGA GTTGACTGTC TTCGTTGACA ATCCACAAAT CCGCTTCAAG	3300
ACTCGCTTTA CTAACACTGC CAAGGATCAC CGTATCCGTC TCTTGGTCAA GACTCATAAC	3360
ACGCGTCCAA GCAATGATTC TGAAGTATC TATGAGGTGG TGACACGACC AAACAAACCA	3420
GCTGCTTCAT GGGAAAACCC TGAAAATCCT CAACACCAAC AAGCTTTTGT CAGTCTGTAT	3480
GACGATGAAA AAGGGGTGAC TGTATCCAAC AAGGGATTGA ATGAATACGA AATCCTTGGG	3540
GATAACACCA TTGCCGTGAC CATTTTGCGT GCATCAGGTG AGCTAGGTGA CTGGGGCTAC	3600
TTCCCAACGC CAGAAGCACA ATGCTTGCGG GAGTTTGAAG TCGAGTTTGC ACTTGAATGC	3660
CACCAAGCCC AAGAACGCTT CTCAGCCTAT CGTCGTGCCA AAGCCTTGCA GACACCGTTT	3720
ACCAGCCTTC AGCTTGCTAG ACAGGAAGGA AGCGTGGTTG CGACTGGTAG CCTCTTGAGC	3780
CATTCTGTTT TCAGCATACC GCAAGTTTGT CCAACAGCCT TTAAGGTAGC TGAAAATGAA	3840

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GAAGGCTATG TGCTTCGTTA CTACAATATG TGTAGTGAAA ATGTACGTGT GCCAGAAAGT	3900
CAACATCTCT TCCTTGACCT ACTTGAACGA CCATACCCAG TTCATTCAGG ACTATTGGCT	3960
CCACAAGAGA TTCGTACAGA ATTCATCAAA AAAGAAGAAA TTTAATTTCA AAAAGTAAAC	4020
ATCAAAAGAA AGGAGGGGCG AAAAAGTAAG AACTAACTGC TGATTCGCCC CTTTATGGT	4080
AAAAACAATG ACCATTGCAA CGATTGATAT CGGAGGGACT GGGATTAAAT TTGCCAGTCT	4140
GACTCCTGAT GGGAAAATAC TGGATAAGAC AAGTATTTCA ACGCCTGAAA ACTTGGAGGA	4200
TTTACTAGCG TGGCTAGATC AACGCTTGTC AGAACAGGAT TACAGTGGGA TTGCTATGAG	4260
CGTTCCAGGT GCAGTCAATC AAGAGACAGG TGTGATTGAT GGCTTCAGTG CGGTGCCCTA	4320
CATCCATGGC TTTTCTTGGT ATGAGGCGCT TAGCTCTTAT CAGCTACCTG TCCATTAGA	4380
AAATGATGCC AACTGCGTTG GACTCAGTGA ACTACTAGCT CATCCAGAGC TTGAAAATGC	4440
AGCCTGTGTC GTGATTGGGA CAGGGATTGG CGGAGCCATG ATTATCAATG GTAGACTTCA	4500
TCGAGGTCGC CACGGTCTGG GTGGAGAATT TGGCTACATG ACAACCCTTG CCCCTGCTGA	4560
AAAACCTAAT AACTGGTCGC AACTAGCATC AACTGGGAAT ATGGTACGAT ACGTGATTGA	4620
AAAATCTGGT CATACTGATT GGGACGGTCG CAAGATTTAC CAAGAGGCCG CAGCTGGTAA	4680
TATCCTTTGT CAAGAAGCCA TTGAGCGCAT GAACCGCAAT CTGGCGCAAG GCTTGCTCAA	4740
TATCCAGTAT CTGATCGATC CAGGTGTCAT CAGTCTGGGT GGCTCTATCA GTCAAAATCC	4800
AGATTTTATC CAAGGTGTCA AGAAGGCTGT TGAAGACTTT GTCGATGCCT ACGAAGAATA	4860
CACGGTCGCA CCAGTTATCC AGGCCTGCAC CTATCAGCA GATGCCAATC TCTACGGTGC	4920
TCTTGTC AAC TGGCTACAGG AGGAAAAGCA ATGGTAAGAT TTACAGGACT TAGTCTCAA	4980
CAAACGCAAG CTATTGAGGT TTTAAAAGGT CACATTTCTC TACCAGATGT GGAAGTGGCT	5040
GTCACCTAGT CTGACCAAGC ATCTATCTCT ATCGAGGGTG AGGAAGGTCA CTATCAATTG	5100
ACCTACCGCA AACCTCACCA ACTTTATCGT GCCTTGTCCT TGTGGTAAC AGTTCTAGCA	5160
GAAGCTGATA AAGTAGAGAT TGAGGAACAA GCAGCTTACG AAGATTTGGC TTACATGGTT	5220
GACTGTTCTC GAAATGCGGT GCTGAATGTG GCTTCTGCCA AGCAGATGAT TGAGATATTG	5280
GCTCTCATGG GCTACTCAAC CTTTGAGCTT TACATGGAAG ACACTTACCA GATTGAAGGG	5340
CAGCCTTACT TTGGCTATTT CCGTGGAGCT TATTCAGCAG AGGAGTTGCA GGAAATCGAA	5400
GCCTATGCCC AACAGTTTGA CGTGACCTTT GTACCATGCA TCCAGACCTT GGCCCACTTG	5460
TCGGCCTTTG TCAAATGGGG TGTCAAGGAA GTGCAGGAGC TCCGTGATGT AGAGGACATT	5520
CTTCTCATTG GCGAAGAAAA GGTTTATGAC TTGATTGATG GCATGTTTGC CACGTTGTCT	5580
AAACTGAAGA CTCGAAGGT CAATATCGGG ATGGACGAAG CCCACTTGGT TGGTTTGGGA	5640

CGCTACCTGA TTCTGAACGG TGTGTGGAT CGTAGTCTCC TCATGTGCCA ACACTTGGAG	5700
CGCGTGCTGG ATATTGCTGA CAAATATGGT TTCCACTGCC AGATGTGGAG TGATATGTTT	5760
TTCAAACCTCA TGTGAGCGGA TGGCCAGTAC GACCGTGATG TGGAAATTCC AGAGGAAACT	5820
CGTGCTCTACC TAGACCGTCT CAAAGACCGT GTGACTCTGG TTTACTGGGA TTATTATCAG	5880
GATAGCGAGG AAAAATACAA CCGTAATTTT CGCAATCATC ACAAGATTAG CCATGACCTT	5940
GCATTGTCAG GGGGAGCTTG GAAGTGGATT GGCTTTACAC CTCACAACCA TTTTAGCCGT	6000
CTAGTGGCTA TCGAGGCTAA TAAAGCCTGC CGTGCCAATC AGATTAAAGA AGTCATCGTA	6060
ACGGGTTGGG GAGACAATGG TGGTGAAACT GCCCAGTTCT CTATCCTACC AAGCTTGCAA	6120
ATCTGGGCAG AACTCAGCTA TCGCAATGAC CTAGATGGTT TGTCTGCGCA CTTCAAGACC	6180
AATACTGGTC TAACGGTTGA GGATTTTATG CAGATTGACC TTGCCAACCT CTTACCAGAC	6240
CTACCAGGCA ATCTCAGCGG TATCAATCCC AACCGCTATG TTTTATATCA GGATATTCTT	6300
TGTCCGATTC TTGATCAACA CATGACACCT GAACAGGACA AACCGCACTT CGCTCAGGCT	6360
GCTGAGACGC TTGCTAACAT TAAAGAAAAA GCTGGAAACT ATGCCTATCT CTTTGAAACT	6420
CAGGCCAGT TGAATGCTAT TTTAAGTAGC AAAGTAGATG TGGGACGACG CATTGCTCAG	6480
GCCTACCAAG CGGATGATAA AGAAAGTTTA CAACAAATCG CCAGACAAGA ATTACCAGAA	6540
CTTAGAAGCC AAATTGAAGA CTTCCATGCC CTCTTTAGCC ACCAATGGCT GAAAGAAAAAC	6600
AAGGCTTTTG GTTTGGATAC AGTTGACATC CGTATGGGCG GACTCTTGCA ACGCATCAAA	6660
CGAGCAGAAA GCCGTATCGA GGTATATCTG GCTGGTCAGC TTGACCGCAT CGACGAGCTG	6720
GAAGTTGAAA TCCTACCATT TACTGACTTC TACGCAGACA AGGATTTTCG AGCAACTACA	6780
GCCAACCAGT GGCATACCAT TCGCAGACG TCGACGATTT ATACGACTTA ATATTCTTCG	6840
AAAATCTCTT CAAACCACGT CAGCTTCCAT CTGCAACCTC AAAACAGTGT TTTGAGCAAC	6900
CTGCAGCTAG CTTCTAGTT TGCTCTTTGA TTTTCATTGA GTATAAAAAC AAGAACACCT	6960
TGCTTGGCGC AGGGTGTTC GCGTGAAACA GAAGAATTAT CTGGTTTCAA ATGCTACAGT	7020
TAGACAAACT TATGATAAAA TAGCAGAAAG TGAATGTTTC CTAAGAGCAA TTGGAGGTAT	7080
TATGCTACAC TTAAATTAG TAAACAAGA AATAGAAGCT GAAAAGCCAG CATCTGTAGA	7140
AGCTTGGATC ATTTCCGTCA AATTTAAAAA AGGTTGCTAC CGACATATAT AGATTCCAAA	7200
AACAAAAACG TTAGCGGAAC TAGCAGATGT GATTTTATGG ACTTTTGATT TTGCAAATGA	7260
TCATGCTCAC GCATTTTCA TGGATAATGT TGAGTGGAGT CATGCAGATT CTTACTTTTCG	7320
TAGCTTTGTT AGTGACGATG TTGAAGAACG TTACACAGAA AATGTCTATC TGGATAGCCT	7380

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AAGTGTCAAA CAAAAATTTA AGTTTATTTT CGACTTCGGT GATGAATGGC GTTTTGAATG	7440
CCAAGTGCTG AGAGAAATCG AGACAGAGGA CGAAGAAGCT TATCTCGTAC GTTCGGTTGG	7500
AACGTCGCCA GAACAATATC CAGATTATGA TGGTTTGTAC TATGAAGAAT GGTAAAATTG	7560
AAATCAGTCT GTGTAGGCTT AGTATTTCOA TAGACTTCCT GCAAACTAG AATCCTAGTT	7620
CATGATTGAT AATACCAGCA ATCAAATTCOA TTCGTAATCC GAAGCGTTTA CGATGATTTT	7680
GATAGGTGTG TGA AACATT TTAACGTTT TACTTTGGC AAAGATGTTT TCAACCTTGC	7740
TTCTCTCCTT AGATAGCGCA TGGTTATAGG CTTTATCTTC AGCTGTTAGT GGCTTGAGTT	7800
TGCTGGATTT ACGTGAAGTT TGTGCTTGAG GACATATCTT CATGAGCCCT TGATAACCAC	7860
TGTCAGCCAA GATTTTACCA GCTTGTCCGA TATTTCTGCA ACTCATTTTG AACAACTTCA	7920
TATCATGACA ATAGTTTACA GTGATATCCA AAGAAACAAT TCTCCCTTGA CTGTGACAA	7980
TCGCTTGAGC CTTCATAGCG TGAAATTTCT TTTTACCAGA ATCATTGCTT AATCTTTT	8040
TTAGGGCGAT TGATTTTAC TCCGTCGCA TCAATCATT CCGTGTCTC AGAACTAAGA	8100
GGAGTTCTTG AAATCGTAAC ACCACTTTGA ACAAGAGTTA CTCAACCCA TTGGCTCCGA	8160
CGGATTAAGT TGCTTTCGTG AATACCAAAA TCAGCCGCAA TTTCTTCATA AGTGCGGTAT	8220
TCTAGGCTTA ATTTAGGTTT TCGTCCACCT TTTGCGTGTT TAAGTTGATA AGCTGTTTTT	8280
AATACAGCTA ACATCTCTTT AAAAGTCGTG CGCTGAACAC CAACAAGACG CTTAAATCGT	8340
GTATCAGTTA ATGTTTACT TGCTTCATAA TTTGCGAGGG AGTCTATGA CTCTTTGGTA	8400
GGTGTCAATG TTTTTTTCAT CTATCCGAG AATTATTTTC CCGCCATTTG TATTTGCAAA	8460
TGCTGAGTAG GTTCCCAGA AAGACTCTGG AAGATTGTTT TTAGCTTTTT TGTATTCTAA	8520
ATCAACCCCT TCAAAATTTA AGTCCATATT TTTCTTTAC ATCTGTTTTT TGTGGTTCTG	8580
GTATTTGTTT AAGTTGAGTG ATAATATAGC GAATTGAATT TCGAGAGTTT TTACTCAGTT	8640
AATTTCTTTT TTAACCC	8657

## (2) INFORMATION FOR SEQ ID NO: 45:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 11384 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO: 45:

TCTATTTTGG GTATAGACTT ACCTATAAAG AAAAATATCT ATACACTGCC TTACTAGCTA	60
TACTGAACGA GTCAACAAAA ACGATATATA TTGATGATAT AAATACAGCA AGATTTTTTA	120



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ACTTCTTTGG CAATGATATT CCTAATTCGT CTTTAAAAA AATTGACTAT ATCGCACCTT	180
CAGAAATTGT TTCATTTAGT ACGTACGTTT GACAACGTTT TAAAGTAATT CCTAAAATTT	240
TGGAACATAT ATTAAATCA AGTTTTTTAT TAGAGAATAT AGATGTTTCT GGTACACTG	300
TAAATATTTT AGAAGATCAA TTAACAAAAC ATAGAACAAT CAAAATTAGT AAAAATAAC	360
TGGTTGATCT CATGTATAAA TACCTAACAA AACCACGCGC CTGCGCTGCT GATGAAAGA	420
AAGGTACAAA TACATGAATA TCAAAGAAA AATCAAAAAG AATGGCCAAA GAGTTTATTA	480
TGCTAGTGTT TATCTAGGCG TTGACCAACT AACGGGCAAA AAAGCCCGTA CAACTGTTAC	540
AGCAACCACT AAAAAGGCGC TTAAAGTAAA AGCGCGTGAT GCGATCAATA CTTTGTCTGC	600
TAATGGCTAT ACAGTTAAAG ACAAGCCGAC AATTACAACA TATAATGAGC TTGTAAAAGT	660
TTGGTGGGAT AGTTACAAGA ATACAGTTAA GCCAAATACT CGCCAATCCA TGGAGGGATT	720
GGTTAGAGTG CATTTATTGC CTGTATTTGG CGATTACAAG CTATCTAAAC TTACTACGCC	780
TATTCTTCAA CAGCAAGTAA ACAAATGGGC TGACAAGGCA AATAAAGGCG AAAAAGGGC	840
ATTTGCTAAC TACTCTTTGC TCCATAACAT GAATAAGCGT ATTTTGAAAT ATGGCGTAGC	900
TATCCAGGTA ATACAATACA ACCCAGCTAA TGATGTCATC GTTCCACGCA AACAGCAAAA	960
AGAAAAGGCT GCTGTCAAAT ACTTAGACAA CAAAGAATTA AAACAGTTTC TTGATTATTT	1020
AGATGCTCTG GATCAATCAA ATTATGAGAA CTTATTTGAT GTTGTTCTGT ATAAGACTTT	1080
ATTGGCCACT GGTGCGGTA TTAGTGAGGC TCTGGCTCTT GAATGGTCTG ATATTGACCT	1140
AGAAAGCGGT GTTATCAGCA TCAATAAGAC ACTAAACCGC TATCAGGAAA TAAACTCACC	1200
TAAATCAAGC GCTGGTTATC GTGATATACC AATAGACAAA GCCACATTAC TTTTACTGAA	1260
ACAATACAAA AACCCTCAAC AAATTCAGTC TTGGAATTA GGCCGATCTG AAACAGTTGT	1320
ATTCTCTGTA TTTACGGAGA AATATGCTTA TGCTTGTAAC TTACGCAAA GCCTAAATAA	1380
GCATTTGAT GCTGCTGGAG TAACTAACGT ATCATTTTAT GGTTCCTGCC ATACACATAC	1440
TACTATGATG CTCTATGCTC AGGTTAGCCC GAAAGATGTT CAGTATAGAT TAGGCCACTC	1500
TAATTTAATG ATCACTGAAA ATACTTACTG GCATACTAAC CAAGAGAATG CAAAAAAGC	1560
CGTCTCAAAT TATGAAACAG CTATCAACAA TTTATAAAAA ATAAGGGTGA CCCATTTCCT	1620
GGCTACCCCT TTAATATACC AAAAATTAGT AGGGGTAGTA AAAAGGGTAT TAAATTATAA	1680
AAAGCACTAA GGGAAAGCGC CCCAAAGTGC TTATTTCAAA GGCTTTATAG CCTATAATCA	1740
CATAAAGAGA TTATTTTTTA AGGTGTAGA ATGATTTCAA TCCACGATAT TCAGCTACTT	1800
CACCAAGTTG GTCTTCGATA CGAAGCAATT GGTGTATTT AGCGATGCGG TCTGTACGTG	1860

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AAAGTGAACC	AGTCTTGATT	TGTCCTGCGT	TAGTTGCAAC	TGCAATATCA	GCGATTGTTG	1920
AATCTTCAGT	TTCACCTGAA	CGGTGTGATA	CAACAGCAGT	GTAACCAGCT	TCTTTAGCCA	1980
TTTCGATAGC	TTCAAAAGTT	TCAGTAAGAG	TACCGATTTG	GTTAACTTTG	ATAAGGATTG	2040
AGTTAGCAGC	ACCTTCTTGG	ATACCACGTG	CAAGGTAGTC	AGTGTTTGTT	ACGAAGAAGT	2100
CGTCACCAAC	AAGTTGTACT	TTCTTACCAA	GACGTCAGT	AAGAGCTTTC	CAACCATCCC	2160
AGTCGTTTTC	ATCCATACCA	TCTTCAATAG	TGATGATTGG	GTATTTGTTA	ACCAATTCTT	2220
CAAGGTAGTC	GATTTGTTCT	GCAGATGTAC	GAACAGCAGC	ACCTTCACCT	TCAAATTTAG	2280
TGTAGTCGTA	AACTTTACGT	TCTTTATCGT	AGAATTCTGA	TGAAGCACAG	TCAAATCCGA	2340
TAAATACGTC	TTTACCTGGT	ACATATCCAG	CAGCTTCAAT	CGCAGCAAGG	ATAGTTTCAA	2400
CACCATCTTC	AGTTCTTCG	AAACGAGGAG	CGAATCCACC	TTTCGTCACCT	ACGGCAGTTT	2460
CCAAACCACG	TGATTTAAGG	ATTTTCTTAA	GAGCGTGGAA	GATTTTCAGCA	CCGTAACGAA	2520
GGGCTTCTTT	AAATGTTGGC	GCACCAACTG	GCAAGATCAT	GAACTCTTGG	AAAGCGATTG	2580
GAGCGTCAGA	GTGAGAACCA	CCGTGATGA	TGTTTCATCAT	TGGAGTTGGA	AGAACTTTAG	2640
TGTTGAATCC	ACCAAGATAG	CTGTAAAGTG	GGATTTCAG	GTAAGTCAGCA	GCAGCACGAG	2700
CTACAGCGAT	AGACACACCG	AGGATTGCAT	TCGCACCCAA	TTTACCTTTG	TTAGGAGTAC	2760
CGTCAAGTGC	GATCATAGCA	CGGTCAATAG	CTTGTTGATC	ACGTACATCG	TAGCCAATGA	2820
TAGCTTCAGC	AATGATGTTG	TTTACGTTGT	CAACAGCTTT	TTGTGTACCA	AGACCACCGT	2880
AACGAGATTT	GTCACCGTCG	CGAAGTTCAA	CTGCTTCGTG	TTCACCAGTA	GAAGCTCCTG	2940
ATGGAACCAT	ACCACGTCCG	AAAGCACCTG	ATTCAGTGTA	AACCTTCTACT	TCAAGTGTTG	3000
GGTTACCGCG	TGAGTCTAGG	ACTTCGCGAG	CGTAAACATC	AGTAATAATT	GACATTTTTT	3060
ACTCTCCTTA	TGAGTTAAAT	TTTTTACACC	TCTATAATAC	CTTAAAACCC	CTCCTTTTTC	3120
AAGAAAAAAC	GTTATCTTTG	TGCAACTTTT	CCTTAACTTT	ATAAAGTAAT	CGCTTCTTTT	3180
TGTCGTGTTT	ATTCTAACTT	TTATGATATA	CTGTTTTCAT	GACAGATTTA	TCAAAACAAT	3240
TACTTGAAAA	AGCTCATGGT	GGGTTAAAAA	TAAATCCGGA	TGAGCAAAGA	CGCTATCTTG	3300
GTACTTTTGA	GGAAAGAGTT	CTTGATATG	TAGATATTGA	CACAGCAAAT	AGCCCTCAGT	3360
TAGAAAAAGG	CTTTTTATTT	ATTTTAGAAA	ACCTTCAGGA	AAAAGCAGAG	CCACTATTTG	3420
TGAAGATTTT	ACCAACTATC	GAATTTGATA	AGCAAGTTTT	CTACTTAAAA	GAAGCAAAAG	3480
AAACTGATAG	TCAAGCCACC	ATAGTATCTG	AAGAGCATAT	TACTTCTCCT	TTTGGCCTGG	3540
TTATTTCATAG	CAATGCACCA	GTTCAAGTAG	AAGAAAAAGA	CCTTCGACTT	GCTTTTCCAA	3600
AACTTTGGGA	AGTTAAAAAG	GAAGAACCAG	CCAAAACATC	CTTATGGAAG	AAATGGTTTA	3660

GCTAAATCTT GCACATATTT AATAAGTGCC CAATATTGGC AGCCGTGCGC TCCAGATAGA	3720
AACTGGCATT TTTCAAACTA TCTTCTAAAG GTTCACTTTT CTCCAAAATA GAAAAGACAG	3780
CTTGATATTT TTCAAATGGT AGGGGAGGTA AATCTTCAGC AAGACTACCG CAAATAGCAA	3840
TAACAGGAAC TCCAACAGGG GTTCTTTTGT CAACACCTAT AGGCGCTTTC CCAGCAAAGC	3900
TTTGACTATC AAGTCTTCCT TCTCCAACAA CAACCAAGTC AGCATCTGAA ACTTTCTTAT	3960
CAAAGTTGAT TAAGTCCAAG CAGGTATCAA TTCCAGACAC GATACTTGCC TGAGCAAAGG	4020
CACACAAACC ACCAGCAAGG CCTCCACCTG CTCCTGCTCC TTTAATTTCT AATGTTGCAG	4080
GTGAGAATTT TTCATAAAAA TCTGGATCG CCTGATCTAC GACTGCAAAC ATAGTCGGAT	4140
GTAGACCTTT TTGATTGCCA AAAGTGTAAG TCGCACCTTG ATGACCACAT AAGGGACTCA	4200
CGACATCTGC TAAATATGA ATTTGAACAC CTTCAGGAAT TTTATAGCAA TTTTCTGTTG	4260
AAACAGAAGC TAAGTTTAAT AAGGATTGAC CGGAAGCAGG CAAGACATTT CCATCCCTAT	4320
CATAAAATTG ATAACCTAAA CCAGCAGCAA TCCCCAGTCC TCCATCATTA CTGGCCGTGC	4380
CACCAACACC GATATAAATA TCTTTAATCC CTTTAGAGAT GAGATGAAGA ATCAACTCTC	4440
CAATACCACA AGTTTGGATT TGAAGTGGAT TTCGTTTCTC TAGCGGAATT TTTCCAAGAC	4500
CAACCAAGTC AGCTACTTCA AATAGTGCCA GTTCCCCTTT TTGAAAATAG CGCATGGCTT	4560
CTTTTGTGCC AAAAGGGTCT GTCACCTGGA TCCATTTTTT TTTTAGGTCA AGAGAATGTC	4620
GGATAGCATC TACAGTACCT TCTCCCCAT CACCAACAGG GCAGAGGAGA CATTTCTACAT	4680
CTGCTATCGA TTGTTGGAAG CCTCTTTTTA TTGCTTCAGC TACCTGTTGA GCTGTCAAGC	4740
TTTCCTTAAA CGAATCCGGT GCAATTACAA TCTTCATATT TTCCCTCAT CTAAACAGTC	4800
AATCAAAGGG AGAACTTCTA AAAAATCCCT CTTGTCAACA TGATGTGGTA TTTCTTTTTT	4860
GAGCACTTCT TTGGCACAAA AGGCGATTCC TAACTTCGCC GACTTCAACA TTAATAGATT	4920
ATTAAACCCA TCACCGATTG CCACCGTTCT TTCTTTAGAA AGTTTtagTT TCTTTCTCCA	4980
TTTTTCCAGA GTCTCTTTTT TGACCTGGGG ACTTATAATT TGTCCAAC TAATTTGCTGT	5040
TAAAAGACCT TCTTTGACTT CAAGCTAGTT GGCAGTGAAG TAGGCAATAC CAAGGGATT	5100
TGCTAATCTC TCCAACATTT GGTGTAAATC CACCAGACAC CAGACCAACT AGGATGCCAT	5160
TCTTTTGAG AATAGAGATG AACTCTGGGA CATTTAGCGA TAGATGAATT GAGTTGAAGA	5220
CGTTATCAAA GACCAAAATA GGAAGACCTT CCAACAAGGA CACTCTTTTT CTAAACTGC	5280
TTTCAAAGAC CAACTCTCCT CGCATTGCTC GACTTGTAAT CTGCGAAATT TCCGCCTCAT	5340
GACCTGCCTC TCTCCCTAAA AGATCAATCA CTTCTTCTAG GATTAAGGTT CCATCTACAT	5400

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CCAAAACACA CAAGCCTTTT ACTTGAGACA TCAGTTCTCC TCTCTAAACA GCCTAAAAAT	5460
CGTATGAAGT CATCATACGA TTTTATCTAT TAATTAAC TAATATGGTA CAAGTCAAGG	5520
TATGACTTGC AGGCTGTATC CCATGAGAAG TCACTCTCCA TAGCTTGT TTGTAGGTTT	5580
CTCCAAATGT CTGGATGGTT TCTATACAAG TCCAATGCTG TTTGGAAAGT CCAATTTAAC	5640
CAATAAGGAG ATAGATTGTC AAAGCTAAAG CCAGTACCGC TTCCTTCGAT TGGATTGAAA	5700
GCGCGAACTG TATCTCGCAA GCCTCCAAC TCAATGGACCA ATGGCAAGGT TCCATAACGC	5760
ATAGCCATCA TTTGAGACAA GCCACACGGT TCAAAACGAC TTGGCATGAG GAAGAGGTCA	5820
CAAGCAGCGT AGATTTCTCTG AGCAAGTTTG ACATCAAAAG TGATATTTGT TGATAGCTTG	5880
TCTGGGTAAA TCTGAGCAAA CCATGAGAAA GCTCCTTCAA AGGCTGGATC GCCAGTTCCC	5940
AAAAGAACAA TCTGAACATC TTCTTGCAAG ATATGGTGAA GACTTTTCGAC CACCACATCA	6000
AAACCTTTTT GACGTGTCAA ACGAGAAACA ATTCCCACCA GTGGAACGTC TGCTCTAACA	6060
GGCAAGCCAA CTCTTTCTTG CAATTTTGCC TTATTTTGG CTTTCCAGA CAAATCTTCC	6120
TGATTGAAAT GATAGCTAA AAGAGCATCC GTCTGAGGAT TATAAAGATC AGCATCAATC	6180
CCATTACGA TACCAGATAC TTTACCAGAC TCCATTTTAA GAATCTGATC CAAATTACAT	6240
CCAACTGAC TAGTCATAAT TTCATGAGCA TAGCTAGGTG AAACGGTTGA AACACGGTTC	6300
GCATAGAGAA TACCTGCCTT CATCCAGTTC AGACAGTTGT TCCATCGAAG GGTGCCATCA	6360
GCGTAACGTT CAAAGCCAAC TCCAAACAAA TCACCAACA TTCCTCTGA AAATTGTCTT	6420
TGGAATTCTA AATTATGAAT GGTAAAACT GTTCAATGT CCTCATAGGC TTGAATCCAA	6480
CGGTATTTTT CCTTCAACAA GAAAGGAATC ATAGCTGTAT GGTAGTCATG AACATGGAGA	6540
AGATCAGGAA TAAAGTCAAT CCTTTCCATA GCCTCAATGG CAGCCAGTTG GAAAAAGGCA	6600
AAGCGTTCTC CGTCATCAAA ATCACCCTAA ACATGACCAC GGAAGAAATA ATATTGATTG	6660
TCAATAAAGT AGAAGGTTAC ACCATTTAAT ACTGTTTCT TAATTCCACA ATACTGTCTG	6720
CGCCAACCAA CGCTCACCTC AAAATGAAGC ACATCTTCAA TCTGATTTC AAATTTAGCC	6780
TCTACCATAT CATAGTAGGG TAAATCACT GCAACTTCGT GCCCAGCTTT TACCAGTGAT	6840
TTTGGAAGAG CGCCAATGAC GTCTCCCAA CCACCTGTTT TTGAAAAGG TGACCCCTCT	6900
GCTGCTACAA ATAAAATTTT CATGAATGAA TATCCTCTGT TACTTTAGCA CCTTCTTAA	6960
CCCAACTGG ATGTTCTGCA GTTCTCGAA TCACAACACC ATGCTCAACT TCAACCCCTT	7020
TGTCCAAGAT AGCATATTCG ACCTGAGCCC CTTCTCCAAT AACAACACGA GGAAGAGCA	7080
GGCTATCTTT AACCAAGCTA TCCTTATGGA CATGAATATT ACGTGATAGA ACAGAATTAG	7140
CTACTTGACC TTCAATAATA CTACCAGAGG CAACTGAGA AGTGCTTACC TTAGATGTAT	7200

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TAGCATAGTA AGTTGGCTCT TCGTTTTTGA CCTTTGTATA AATCTTTTGG TTTGGTGAGA	7260
AAAGAGAATA GAATTTTGTG GATTCAAGCA TATCGATATT CGCTTGATAA TAAGATTTAA	7320
CAGAGTGAAT ATTGGCTAGA TAGCCCGTGT ACTCGTAGGC GAAAGCTCCC TCTTTTACAG	7380
CCAAATCCCG TAAACATAG CGCAATTTCT CTGGATGTTT TTTTGTAGCT TCTTCTTCCA	7440
AGTGTTCAAT CAACCAAGGT GTATCAACGA CAAAGATATC TGTAACGTTT	7500
CAGCTGTGTA CTTGCTATCA AAGAGTTTAT GAGAAAGAAC ATGGTCTGTT TCATCTACAT	7560
CCAAGATTGC ATTTACTTCT GAAATATCTT TCTTAGCTAG TTTTGTATAA ACTACAGTGA	7620
TAGGCTCTTT TGTGTACTA TGTAGGTGGA AAAGTTGGTT CAAATCAATG TTAATAAGAA	7680
CATCGCAGTT GAGGGCAACC GTTTGGTTTG AGCCAGAACG TTTCAAATAA GTAAGAAGCT	7740
GTGTTAGTA TTCTTTTCCA ACTGTACTAC TTTCTACACG GGTATTGTAA ATTCCTAGAT	7800
AGTAATGGCT AAGAAGGGTT GATAAGCCCC ACTCGCGTCC TGAACGAATA TGGTCAAATA	7860
CTGAGCTGAT ATTATCCTGC TGGAAAATAC CAAAGACACT ACGAACACCT GCATTAGCAA	7920
GGCTTGAAAG TGGGAAGTCA ATCAAACGAT ATTTCCCACC AAATGGCAAA CTTGCTACTG	7980
GACGGTGGTC CGTCAATGTC GACATATGTT GAAAACCAAC TGTATTTCTT AAAATGGCAG	8040
AATATTTATC AATCTTCATC TGTGCTTACC CCCACTACTT CATTATATCC TACAACCTGT	8100
ACTTCATCTG TTCCATCAAT TTCGACACCG TCAGAAATAA TCGCACCTTC ACCAATAATG	8160
GCACGTTTAA TCTTAGCTCC TTGACCAATG ATAGCTCCAC TCATGATAAC TGAATCAAGG	8220
ACTTCCGCTC CTTGCGGAAC TTGCGCGCCT GTTGAAAGGA TAGAATGTTT AACAGTTCCA	8280
TCAACGAAAC ATCCGTCTAC AACTAATGAG TCTTCCACAT GAGCATTGTC CCCGAGGAAG	8340
TTTGGTGGTG AAATCAAGTT TCTTGAGTAA ATCTTCCATT GACGGTTACG ACTATCCAAG	8400
GCATTTTCTG GAGAAATATA CTCCATGTTT GCTTCCCAA GTGACTCAAT AGTACCAACA	8460
TCTTTCCAAT AACCACTAAA TTCGTAAGCA TAAACACTTT CACCTGACTC AAGGTAATTT	8520
GGAATGACAT TTTTACCAA GTCTGACATG CCAACCTTGC TCTTTTCAGC AGCGACTAAC	8580
ATATTACGAA GGCCTTGCCA ATCAAAAATG TAGATTCCCA TAGAAGCTTT TGTAAGTTTA	8640
GGTTGAGCTG GTTTTTCTTC AAATTCAACA ATACGATTGT TAGCATCTGT GTTCATGATA	8700
CCAAAACGGC TTGCTTCTTT AAGAGGGACG TCTAAAACG CTACTGTCAA GCTGGCATT	8760
TTATCCTTAT GAGACTGGAG CATATCATCA TAGTCCATTT TGTAAGTGTG ATCCCCAGAC	8820
AAAATCAAGA CATACTCAGG ATTGACACTG TCGATATAGT CGATATTTTG GTAAATAGCG	8880
TGACTAGTCC CCTCAAACCA ACGATTTCCT TCACTTGACG AATAAGGTTG AAGAATAGAG	8940

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ACACCTGAAT TAATACCGTC TAGTCCCCAG CTTGAACCAT TCCCAATATG GTTGTGAGA	9000
GCAAGTGGTT GATACTGTGT AACGACCCCA ACATTGTGAA TCCCTGAGTT GGCACAGTTT	9060
GATAGGGCAA AGTCAATGAT ACGGTAGCGC CCACCAAATT GCACAGCTGG TTTTGGGATG	9120
CTTTGAGTGA GTTTACCGAG ACGAGTTCCT TGCCCACCAG CAAGAATCAA AGCTAACATT	9180
TCATTTTCA TTTTCTACTC CTTTTTGGTT TTTATTGTG ACGGTTTTAG TAGATTCAA	9240
GCGACGTTTG ATTTTCATA CACTTGCTCC CATAGCCGGT AGGGTAAAGG TTAAGGTCTG	9300
CTCATAATCT TTCCATAGTC CTTCTGCGT TTGAACAGTT TGATTATGTT CTTCCAAAC	9360
GCCTCCCCAC TCTTCCAAC CAGTATTCCA TACTTCTTCG TAAATCCTG CAACGGGTAG	9420
TCCGATTGTA AAATCTTCC GCTCAACAGG TACCATATTA AAGATACAGA CTAACATTTC	9480
TCCCTTTTTA CCCTTACGAA TAAAGGAAAG AACACTCTGG TCTCGATTAT CCGCATCAAT	9540
GATTTCAATA CCATCATAGC TGGTATCAAT TTCCCACAGA CAGCGATGAT CTTGTAAAA	9600
CTGGTTTAGC TGAGAAGCGA AATACTTCAT CTTAGCATTC ATTGGGTCTT CTAGGTTAGA	9660
CCATTCCAAC TGTTCTTCAG ATTTCCATTC TAGGAATTGA CCGTATTCGC TACCCATGAA	9720
GAGCAATTTT TACCAGGGT GACAAATTTG GTACGTATAG AGATTGCGCA AGCCTGCGAA	9780
TTGATTGTAA CGATCTCCCC ACATCTTATG CATCATACTC TTCTTGCCAT GAACCACTTC	9840
ATCGTGCAG AATGGCAAGA GATAATTCTC CTGAAAACA TACATAAAGC TGAAAGTCAC	9900
CAGGTAAAG TCATATTTAC GATAGATCGG ATCTTCTTCG TAGAAACGGA GGATATCATT	9960
CATCCAGCCC ATGTTCCATT TGTAGTCAAA TCCTAGACCA CCAATCTCTT TCATTCCCGT	10020
AATCTTGATC GCAGACGAAC TTTCTTCTGC AATCATCATC ACATCTGGAT ATTCTAACTT	10080
AATAACCTCA TTCAAGCGCT GAAGGAAATA ATAACCTTCA TAGTTGAGAT TTCCGCCATC	10140
TTTATTAGGT GTCCATGGAG CATCATCATA GTCCAAATAG AGCATGTTGC TAACAGCATC	10200
CACACGAATA CCATCCAAAT GATAGACATC AATCCAATGC TTAATGCAAG AAATTAAGAA	10260
GGACTGGACT TCATTTTTTC CAAGGTCAAA ATTAAGGGCA CCCCACCAT GGTATGAGC	10320
CTTATTATGG TCTTGGTATT CAAAAGTCGG TGTCCTATCA TAATAGGCTA AGGCATCATC	10380
GTGTATGGTA AAGTGACTGG TACCCAGTCC ACAATAACCC CAATATTATG GGTATGACAC	10440
TCCTCGACAA AATCTTGAAA CTCCTCTGGT CGGCCATAAG CATGCTCTAA AGCGAAGTAA	10500
CCCATAAGCT GATACCCCA ACTCAAGCCC AAAGGATGGG ACATCAAGGG CATAAACTCA	10560
ATATGAGTAT AGTTCAATTC AACGAGATAA GGAATGAGTT CATCCTTGAG CTGGGCAAAA	10620
CTATAAGGAC TGCCATCAGA ATTTCTTTTC CATGATCCAG CGTGAACCTC ATAAATATTG	10680
ACAGGACGCT CTTCAAAGCC CCAACGTTT CTTCTGCGCA GCCAAAGTCC ATCCTTCCAT	10740

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TTCTTCTCAG GAAGCTCTGT TACGATTGCC CCGTTCCCTG GACGAGCCTC ATACCTGACA	10800
GCAAAAGGGT CAATCTTCAT CAGTTGATGA CCATTTTGAC GTGTGACATG ATATTTGTAA	10860
ATATGCCCTT CTTGAGCCAT ATTGGTAAAG ACTTCCCAGA CCCCAAATC ATTTCTTACC	10920
ATTGGAATCT GATTTTCAAT CCAGTTGGTA AAATCACCAA CCAAGTGAAC AGCCTGAGCA	10980
TTAGGTGCCC AAACACGGAA GGTATAGCCA TGCTCTCCAT TTAGTTCCTC CCTATGTGCT	11040
CCTAGATAAT GTTGAGATA AAAATTTTCA CCCGTCATAA AGGTTTTTAA TGCTTCTCTA	11100
TTATCCATAT ACTCCCCTTC TCCTGTAAGC GTTTTCTATG TTTTATTAT ACTACCTTTT	11160
TAGAGAAGAT TCAAGTAAAT TACTATACTT CTTTAATTAT TTTGAAAATC TACAACAAGT	11220
TCACCTACTC GTTCAATTGT AAATCAATAT TTTTCAAAA AATTGCGAAA ACGCCTTTCT	11280
TTTTCTACTA TAGTGAAATG AAATAAACA TGCGCAAATC GATTAAGGAA TTTAATCTAA	11340
TTTCTAACAA TGTCTTAGAA ATCAAAGTGT ACTATTTTAA CTCC	11384

## (2) INFORMATION FOR SEQ ID NO: 46:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 7577 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO: 46:

TGTTGATTTG TTAGTAGACG TTGACCAACG TCCTTCGGCT GGAAAAGGAA TTCTCCTTAG	60
TTTCCAACAC GTTTTCGCCA TGTTTGGTGC GACCATCTTG GTACCATTGA TTTTGGGAAT	120
GCCTGTATCT GTTGCCCTTT TTGCTTCAGG TGTTGGAACA CTCATCTACA TGATTGCTAC	180
TGGTTTTAAA GTTCCAGTTT ATCTAGGTTT TTCATTTGCC TTTATCACAG CTATGTCACT	240
GGCTATGAAA GAAATGGGGG GGGATGTATC TGCTGCCCAA ACAGGGGTTA TCTTGACTGG	300
TTTGGTCTAT GTCCTTGTG CTACCAGCAT CCGATTTGTA GGAACAAAAT GGATTGATAA	360
ACTCTTGCCA CCAATCATT TCGGTCCTAT GATCATCGTT ATCGGTCTTG GACTTGCAGG	420
TTTCTGCTGT ACCAATGCAG GTCTTGTAGC AGACGGAAAT TGGAAAAATG CTCTGGTAGC	480
CGTTGTACTT TTCCTAATTG CTGCCTTTAT CAATACAAAA GGAAAAGGCT TCCTACGAAT	540
CATTCCATTC CTCTTGCCA TTATCGGTGG TTACCTTTTC GACTAATCTC TTGGCTTGGT	600
TGACTTTACA CCAGTTCTTA AAGCCAACG GTTCGAAATT CCTGGTTTCT ACTTGCCATT	660
TAGCACAGGT GGTGCCTTTA AAGAGTACAA TCTTTACTTT GGTCCAGAAG CCATCGCTAT	720

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CTTGCCAATC GCTATCGTAA CAATTCTCTGA ACATATCGGA GACCATACTG TTTTGGGTCA	780
AATCTGTGGT CGTCAATTCT TAAAAGAACC AGGTCTTCAC CGTACTCTTC TTGGTGACGG	840
TATCGCAACT TCTGTTTCTG CCTTCCTTGG TGGACCAGCC AATACAACCTT ACGGAGAAAA	900
TACAGGGGTT ATCGGTATGA CTCGTATCGC TTCTGTCTCA GTTATCCGTA ACGCTGCCTT	960
CATCGCGATT GCCCTCAGCT TCCTTGGTAA ATTCACTGCC TTGATTTCAA CTATTCCAAA	1020
CGCTGTACTT GGTGGTATGT CAATCCTTCT CTATGGGGTT ATCGCCAGCA ATGGTTTGAA	1080
AGTCTTGATT AAAGAACGTG TTGATTTCGC TCAAATGCGA AACCTCATCA TCGCAAGTGC	1140
TATGTTGGTT CTGGGACTTG GAGGAGCTAT CCTTAAACTT GGTCCAGTTA CACTTTCAGG	1200
TACTGCCCTT TCAGCCATGA CAGGAATCAT CTGAACTTG ATCTTGCCAT ACGAAAATAA	1260
AGACTAAGAG TCTAAATACA CCTAATCCAC TCAGACAGCT GAGTGGATTT TTCGTATACC	1320
ATAATAAAAG TGTCTTAACA AAATTATTAA AATCAAAAAA CGTATAATAT CAGATATTCT	1380
AAAACCTTGA TACTGTACGT TTTATCATAG AAATTTTAC TTTATTTTCT CATCAAATGA	1440
GATTTCATC AATCTCTTGT CTTACTTGGC TTCTCTCTTC GCTTTCCTCA TTTTGTAGC	1500
CATACGTTTC ATGGACTGTT TCATGGCAAA TTCACCAATT TTACCTTTCA AACCGCCACC	1560
AAACATCTGG CTCATATCTG GCATTCCTGC TCCTCCGAGA GCTGATAAGT CAGGCATACC	1620
GCCTTGTCCT ATCATTCCTT CAAGGGCAGA CATATCCATT CCTCCCATAT TTGGCATATT	1680
TTTAGGAAGG TTATTTGGAT TAATCCCAT TTGCTTCATC ATTTTATTCA TATCCCCAGA	1740
CATAACACCC TGCATGAGCT GTTTAGCCTG GTTAAAGTCC TTGATGAATT TATTGACTTC	1800
GACGAATGTA TTTCCAGAAC CAGCAGCAAT ACGACGGCGA CGGCTTGGAT TTAACAAATC	1860
TGGGTTTTCA CGCTCTTCAG GTGTCATCGA AGACACAATG GCACGTTTAC GAGCAATCTG	1920
GCGTTCATCC ACCTTCATGT TTTGAAGGGC TGGATTGTTG GCCATACCTG GAATCATCTT	1980
GAGCAAGTCT TCCATCGGCC CCATATTTTG CACCTGATCT AATTGATCGA TGAAATCATT	2040
AAAATCAAAG GTGTTTTTCG GCATCTTCTC AGCCATTTC AAGGCTTTTT GTTCATCGTA	2100
TTCTGAGAA GCTTTCTCAA TCAAAGTGAG CATATCCCC ATACCAAGGA TACGGCTAGA	2160
CATGCGGTCT GGGTGAAGG TTTCATGTC CGTAATCTTT TCACCTGTAC CAGTGAACCT	2220
GATTGGTTTT CCAGTAATGT GACGAACAGA CAGAGCAGCA CCACCACGAG TATCGCCATC	2280
AATCTTGTA AGGATGACCC CAGTCACTTC CAACTGAGCA TTAAACTCAC GCGCAACATT	2340
GGCTGCTTCC TGACCAATCA TAGCATCAAC GACAAGCAAG ATTTTCATTG GTTGAGCCAA	2400
TGCTTTTACA TCACGAAGCT CATTATGAG GAGCTCATCA ATCTGCAAAC GACCCGAGT	2460
ATCAATCAAG ACATAGTCGT TATGATTAGT TTGGGCTTGC TCCAAACCTT GACGTACAAT	2520



425

CTCAACAGCT GGTACTTCTG TTCCAAGTGC AAAGACAGGC ACATCAATCT GTTGTCCTCAA	2580
GGTCTTAAGC TGGTCAATGG CAGCTGGACG ATAAATATCC GCCGCAATCA TCAAAGGACG	2640
AGCATTTTCT TCTTCTTGA GTTTGTTGGC CAATTTACCA GCAAAGGTTG TTTTACCAGC	2700
CCCTTGTAAG CCAACCATCA TGATGATGGT TGGAACTTA GGTGACTTGA TAATTCTGTC	2760
CGTATCAGAA CCTAAACGG CTGTCAATTC CTCATCAACG ATTTTAATAA TCTGTTGCGC	2820
AGGATTAAGT GTATCAATGA CCTCATGCCC GACTGCACGC TCACGAACTT TCTTGATAAA	2880
GTCCCTTACA ACAGGCAAGG CAACGTCGGC CTCGAGCAAG GCCAAGCGAA TTCTTTGGT	2940
TGCCTCTTGG ACATCAGATT CAGAGATTTT TCCTTTTTTA CGTAGATTTT TAAAGACGTT	3000
CTGCAACGT TCTGTAAAC TTCAAATGC CATTTTCTT CCTCTTATTC TCTATTATCA	3060
ATGCTTGTTA AAATTCTAT CTGCTCCTGC AGAAAGTCAT CCTTGGGATA GCGCTCCAAA	3120
ATCTGATCAA AAATCTGACT GCGGACAATA TAGTCCGAGT ACATGTGCAA TTTCATCTCA	3180
TAATCTTCCA GAATCTTTC TGTTCGCTTG ATATTGTCAT AGACAGCCTG ACGACTGACA	3240
CCGAATCCT CGGCAATTTC AGCAAGGCTG TAATCATCAG CGTAGTAGAG CTCGATATAA	3300
TTCAATTGCT TATCTGTCAA AAGCGCCGCA TAAAAATCAA AGAGCGCATT CATACGATTG	3360
GTTTTTTCGA TTTCATAAC TTTTATTATA CAAAAATTA GCCTAATCTA CCACACTAGG	3420
AAGCCGATCC AAGAAGATAG ATAGCTAAAT TTGAAAAAGA CATGAGCCTA GCCCAAGTA	3480
ATTTCCAATT GATAGCTGGC AAAGGGATGT CCCTCTTGAT TTTGTAGTTG ATAATCTAGT	3540
TCAATCTTTT GCCTATCAAC TTGATAATGG CTCGTTTGA TGATAAACTC CTGCATGCCC	3600
ATAGGTGTAG GAATATAGGC TAAACTATCG CTATCCTTTA GAAAGCGCAT AATGGTCTTG	3660
GGATTAGAAA ATCGGCTCAT CACAAGTTCT TGACCATGAA ATTTAATCAC TACTTTTCC	3720
TTTTCTCAT TATAGAAAAG CAGGTAGCTA TAATCTCCTT TTTTATGCAC TTCCACATCA	3780
TAAAGCTGGT CAATCACTTC CAACTGCTCA TCAAACTGAA TCGTATTTTCG CATCCGAATC	3840
TTACATCAG GCCCTCTTTC TTGTCTCTTG TCCTACTATT TTACCAAAAA GAGCAGGATT	3900
TTGCTATAAT GGTCAATGA ACGAAAAAGT ATTCCGTGAC CCTGTTCACA ACTACATCCA	3960
TGTCAATAAT CAAATCATCT ATGACTTGAT TAATACAAAA GAATTCAGC GTTTGCGCCG	4020
GATCAAACAA CTGGGAACCT CCAGTTATAC CTTCCACGGT GGAGAACACA GTCGCTTCTC	4080
TCACTGTCTA GGAGTCTATG AAATGTCACG ACGCATCACA GAGATTTTCG AAGAAAAATA	4140
TCCTGAGGAA TGGAATCCTG CCGAGTCTCT CTTGACCATG ACCGCTGCTC TCCTACACGA	4200
CCTTGGGCAT GGTGCCTACT CCCATACTTT TGAACATCTC TTTGATACAG ACCATGAAGC	4260

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CATTACTCAG GAGATTATTC AAAATCCTGA GACAGAGATT CACCAAGTCC TGCTACAAGT	4320
GGCACCTGAT TTCCCAGAAA AGGTGGCCAG TGTCATTGAC CATACCTATC CTAATAAGCA	4380
GGTCGTGCAG CTCATTCTTA GTCAGATTGA CGCAGATCGC ATGGACTATC TCTTGCGCGA	4440
CTCCTATTTT ACAGGAGCAT CCTATGGGGA ATTTGACCTG ACTCGAATCC TCCGAGTCAT	4500
TCGTCCTATC GAAAAATGGTA TCGCCTTTCA GCGCAATGGC ATGCACGCCA TCGAAGACTA	4560
CGTCCTCAGT CGCTACCAGA TGTACATGCA GGTTTATTTT CACCCCGCAA CACGCGCCAT	4620
GGAAGTTCTC CTACAGAATC TTCTCAAACG CGCCAAGGAA CTCTATCCTG AGGACAAGGA	4680
TTTCTTTGCC CGAACTTCTC CACACCTCCT GCCTTTCTTC GAAAAAATG TGACCTTGAC	4740
TGACTATCTG GCTCTGGATG ATGGCGTGAT GAATACCTAC TTCCAGCTTT GGATGACCAG	4800
TCCTGACAAG ATTCTTGCGA ATTTATCGCA TCGCTTTGTC AACCGCAAGG TCTTTAAATC	4860
CATTACCTTT TCACAAGAGG ACCAAGATCA ACTTACTAGC ATGAGAAAAT TGGTTGAGGA	4920
TATCGGCTTT GATCCCGACT ACTACACTGC CATTACATAAG AACTTTGACC TCCCTTATGA	4980
TATCTATCGT CCCGAATCTG AAAACCCACG GACACAGATT GAGATTTTAC AAAAAAATGG	5040
AGAACTGGCC GAACTCTCTA GCCTGTCTCC TATCGTCCAA TCCCTTGCTG GCAGTCGCCA	5100
CGGAGATAAT CGCTTTTATT TTCCAAAAGA AATGTTGGAC CAAAACAGCA TCTTTGCAAG	5160
CATTACCCAG CAATTTTATC ACTTGATTGA GAACGATCAT TTTACCCCAA ATAAAACTA	5220
GAAGAGGAAA TTTATGAGTA TTAAACTAAT TGCCGTTGAT ATCGACGGAA CCCTTGTCAA	5280
CAGCCAAAAG GAAATCACTC CTGAAGTTTT TTCTGCCATC CAAGATGCCA AAGAAGCTGG	5340
TGTCAAAGTC GTGATTGCAA CTGGCCGCCC TATCGCAGGC GTTGCCAAAC TTCTAGACGA	5400
CTTGCAAGTG AGAGACGAGG GGGACTATGT GGTAACCTTC AACGGTGCCC TTGTCCAAGA	5460
AACTGCTACA GGACATGAGA TTATCAGCGA ATCCTTGACT TATGAGGATT ATCTAGATAT	5520
GGAATTCTC AGTCGCAAGC TCGGTGTCCA CATGCATGCC ATTACCAAGG ACGGTATCTA	5580
TACTGCAAAT CGCAATATCG GAAAATACAC TGTACACGAA TCAACCTCG TCAGCATGCC	5640
TATCTTCTAC CGTACCCCTG AAGAAATGGC TGGCAAAGAA ATTGTTAAAT GTATGTTTAT	5700
CGATGAACCA GAAATCTCTG ATGCTGCGAT TGAAAAAATT CCAGCAGAAT TTTACGAGCG	5760
CTACTCCATC AACAAATCTG CTCCTTTCTA CCTCGAACTC CTTAAAAAGA ATGTAGACAA	5820
GGGTTGAGCC ATTACTCACT TGGCTGAAAA ACTCGGATTG ACCAAAGATG AAACCATGGC	5880
AATCGGTGAT GAAGAAAAATG ACCGTGCCAT GCTGGAAGTC GTTGGAAACC CCGTTGTCAT	5940
GGAAAAATGA AATCCAGAAA TCAAAAAAAT CGCCAAATAC ATCACCAGAA CAAATGACGA	6000
ATCCGCGGTT GCCCATGCCA TCCGAACATG GGTACTGTAA AAGTATCATT TTTCAATAAG	6060

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AATTGATTAG CAATAAAATC CAATGAATTT TTTTAGCAAA CTATTTAATT TAAAACAAAA	6120
TAATCATAAT AGAGACACAA ATTCTGATTG TAACAATTTT TACCTAAACG AATTAGAATG	6180
TGGCCTTACT CCTGGGCAAC TCATACTCAT AGATTGGACT CAAAAAACAG GGAGAAATTA	6240
TAATTTCCCA AGATATTTTA AATACTCTCT TCAAATTGAC CCTGAATCTA CACACAATCA	6300
ATTATACAAA TTAGGATACT TCACTAAAAA TAAGACTTTA TCATATCTTA CAGTAGTAGA	6360
ATTAAAAACT ATATTATCTA AACATAATTT AGCTACTTCT GGAAAAAAG CAGAATTAAT	6420
TACAAGAATA ATTAATAATG TTAACATTGA CAATTTAGAT ATTCCGTTTCG AATTTAAACT	6480
AACAAAAGAA GCACAAAATC TTATTATCGA ACATAGTGAC TATATCAAAG CATACTATGA	6540
TAAAGACATA ACTATGGAAG ATTATGTAA AGAAAAAAC AATATCTCTT TTAAGCAAC	6600
TTTTGGTGAT ATAAAATGGA GTCTCTTAAA TAAACAAGCT CATAGGAATA CTGTATCAGG	6660
AGATTTTGGA TGCTTATCTA ACACACGAAA GGCTCAGGGA AGACATTGG AACAGAAGG	6720
TAATATTAAG CATGCTTTAA TATATTACAT AGAATCTTG ATAATTACTA TTTCAGGATT	6780
AGAAAACAAT TTTTCAGCCA CTGATTATCC AGTATATTAT CCCGATTCGA TACCTGACTA	6840
CTCACTAAAA CATATTCAAA CATTAATGGA ATCATTATCT GATGACGATT ATGATTTTGC	6900
TTTTGATGAA GCATTATTTT GCTTCTCAAT TTTGAATGCA AATCATTTT TATCTAAGGA	6960
AGATATTGAC TATTTAAGAG TTAATTTACC TCGTTCCACT GCTGAAGAAA TAAACAATTA	7020
CTTAAAGAAA TATGAATGTT ATAGTCCTTT AAATAATTTA GAACCTGACG ATTTTGAATA	7080
AATTGACTAT ACAAACATTT ATATACTCGA TATAGTCTCA ATTTTATCTG ATGATTGCCC	7140
AAATTTTCA ATAATAAAC GCATAATATT ATGGAGACAA TCCCCTATAT TATGCGTTCT	7200
TTTAATATCA AAGACTTTT GACAACTTC TTTGATATCT AATTACATGC CCCCTGCAGG	7260
AATCGAACCT GCAACTACTC CTTAGGAGGG AGTTGTTATA TCCATTGAAC TAAGGGAGCT	7320
AGATAAAAAC TCTGCTAAAT GAGCAGAGTT TTTTAGTCGA ATTAACGACG GATTTCCTTG	7380
ATACGAGCTG CTTTACCTTG AAGAGCACGC AAGTAGTACA ATTCGCACG ACGTACTTTA	7440
CCGTAAACGAA CAACTTCGAT TTTTCAACA CGTGGAGTGT GGATTGGGAA GATACGCTCA	7500
ACACCTACAC CGTTAGAGAT TTTACGAACT GTGTAGTTT CTGAGATTCC AGCACCTTA	7560
CGTGCATAA CAACAG	7577

(2) INFORMATION FOR SEQ ID NO: 47:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 4945 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double

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(D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 47:

CCTCGCTGAT GATTGGTGCT GTTTTATTTG CTGGTCCAGC CTTGGCTGAA GAAACTGCAG	60
TTCTTGAAAA TAGCGGAnCT AATACAGAGC TTGTTTCAGG AGAGAGTGAG CATTCGACCA	120
ATGAAGCTGA TAAGCAGAAT GAAGGGGAAC ATGCTAGAGA AAACAAGCTA GAAAAGGCAG	180
AAGGAGTAGC GATAGCATCT GAAACTGCTT CGCCAGCAAG CAATGAAGCT GCAACTACTG	240
AAACTGCAGA AGCAGCTAGC GCAGCTAAAC CAGAGGAAAA AGCAAGTGAG GTGGTTGCAG	300
AAACACCATC TGCAGAAGCA AAACCTAAGT CTGACAAGGA AACAGAAGCA AAGCCCGAAG	360
CAACTAACCA AGGGGATGAG TCTAAACCAG CAGCAGAAGC TAATAAGACT GAAAAAGAAG	420
TCCAGCCAGA TGTCCTTAAA AATACAGAAA AAACATTAAA ACCAAAGGAA ATCAAATTTA	480
ATTCTTGGGA AGAATTGTTA AAATGGGAAC CAGGTGCTCG TGAAGATGAT GCTATTAAAC	540
GCGGATCTGT TGTCCTCGCT TCACGTCGGA CAGGTCATTT AGTCAATGAA AAAGCTAGCA	600
AGGAAGCAAA AGTTCAAGCC TTATCAAACA CCAATTCTAA AGCAAAAGAC CATGCTTCTG	660
TTGGTGGAGA AGAGTTCAAG GCCTATGCTT TTGACTATTG GCAATATCTA GATTCAATGG	720
TCTTCTGGGA AGGTCTCGTA CCAACTCCTG ACGTTATTGA TGCAGGTCAC CGTAACGGGG	780
TTCTGTATA CGGTACACTC TTCTTCAACT GGTCTAATAG TATTGCAGAT CAAGAAAGAT	840
TTGCTGAAGC TTTGAAGCAA GACGCAGATG GTAGCTTCCC AATTGCCCCG AAATTGGTAG	900
ACATGGCCAA GTATTATGGC TATGATGGCT ATTTCATCAA CCAAGAAACA ACTGGAGATT	960
TGGTTAAACC TCTTGAGAA AAGATGCGCC AGTTTATGCT CTATAGCAAG GAATATGCTG	1020
CTAAGGTAAA CCATCCAATC AAGTATTCTT GGTACGATGC CATGACCTAT AACTATGGAC	1080
GTTATCATCA AGATGGTTG GGAGAATACA ACTACCAATT CATGCAACCA GAAGGAGATA	1140
AGGTTCCGGC AGATAACTTC TTTGCTAACT TTAAGTGGGA TAAGGCTAAA AATGATTACA	1200
CTATTGCAAC TGCCAACTGG ATTGGTCGTA ATCCTTATGA TGTATTGCA GGTTTGGAAT	1260
TGCAACAGGG TGGTTCCTAC AAGACAAAGG TTAAGTGGA TGACATTTTA GACGAAAATG	1320
GGAAATTGCG CCTTCTCTT GGTTTATTTG CCCCAGATAC CATTACAAGT TTAGGAAAAA	1380
CTGGTGAAGA TTATCATAAA AATGAAGATA TCTTCTTTAC AGGTTATCAA GGAGACCCTA	1440
CTGGCCAAAA ACCAGGTGAC AAAGATTGGT ATGGTATTGC TAACCTAGTT GCGGACCGTA	1500
CGCCAGCGGT AGGTAATACT TTTACTACTT CTTTAAATAC AGGTCATGGT AAAAAATGGT	1560
TCGTAGATGG TAAGGTTTCT AAGGATTCTG AGTGAATTA TCGTTCAGTA TCAGGTGTTT	1620

TTCCAACATG GCGCTGGTGG CAGACTTCAA CAGGGGAAAA ACTTCGTGCA GAATATGATT	1680
TTACAGATGC CTATAATGGC GGAAATTCCC TTAAATTCTC TGGTGATGTA GCCGGTAAGA	1740
CAGATCAGGA TGTGAGACTT TATTCTACTA AGTTAGAAGT AACTGAGAAG ACCAAACTTC	1800
GTGTTGCCCA CAAGGGAGGA AAAGGTTCTA AAGTTTATAT GGCATTCTCT ACAACTCCAG	1860
ACTACAAATT CGATGATGCA GATGCATGGA AAGAGCTAAC CCTTTCTGAC AACTGGACAA	1920
ATGAAGAATT TGATCTTAGC TCACTAGCGG GTAAAACCAT CTATGCAGTC AAATATTTT	1980
TCGAGCATGA AGGTGCTGTA AAAGATTATC AGTTTAACCT AGGACAATTA ACTATCTCGG	2040
ACAATCACCA AGAGCCACAA TCGCCGACAA GCTTTTCTGT AGTGAAACAA TCTCTTAAAA	2100
ATGCCCAAGA AGCGGAAGCA GTTGTGCAAT TTAAAGGCAA CAAGGATGCA GATTTCTATG	2160
AAGTTTATGA AAAAGATGGA GACAGCTGGA AATTACTAAC TGGCTCATCT TCTACAACTA	2220
TTTATCTACC AAAAGTTAGC CGCTCAGCAA GTGCTCAGGG TACAACTCAA GAACTGAAGG	2280
TTGTAGCAGT CGGTAAAAAT GGAGTTCGTT CAGAAGCTGC AACCACAACC TTTGATTGGG	2340
GTATGACTGT AAAAGATACC AGCCTACCAA AACCCTAGC TGAAAAATATC GTTCCAGGTG	2400
CAACAGTTAT TGATAGTACT TTCCCTAAGA CTGAAGGTGG AGAAGGTATT GAAGGTATGT	2460
TGAACGGTAC CATTACTAGC TTGTACAGATA AATGGTCTTC AGCTCAGTTG AGTGGTAGTG	2520
TGGATATTCG TTTGACCAAG CCACGTACCG TTGTTAGATG GGTGATGGAT CATGCAGGAG	2580
CTGGTGGTGA GTCTGTTAAC GATGGCTTGA TGAACACTAA AGACTTTGAC CTTTATTATA	2640
AAGATGCAGA TGGTGAGTGG AAGCTAGCTA AGGAAGTCCG TGGTAACAAA GCACACGTGA	2700
CAGATATCAC TCTTGATAAA CCAATCACTG CTCAGACTG GCGCTTGAAT GTTGTCACCTT	2760
CTGACAATGG AACTCCATGG AAGGCTATTC GTATCTATAA CTGGAATATG TATGAAAAGC	2820
TTGATACTGA GAGTGTCAAT ATTCCGATGG CCAAGGCTGC AGCCCGTTCT CTAGGCAATA	2880
ACAAGGTACA AGTTGGCTTT GCAGATGTAC CGGCTGGAGC AACTATTACC GTTTATGATA	2940
ATCCAAATTC TCAAACCTCG CTCGCAACCT TGAAGAGCGA AGTTGGAGGA GACCTAGCAA	3000
GTGCACCAAT GGATTTGACA AATCAATCTG GTCTTCTTTA TTATCGTACC CAGTTGCCAG	3060
GCAAGGAAAT TAGTAATGTC CTAGCAGTTT CCGTTCCAAA AGATGACAGA AGAATCAAGT	3120
CAGTCAGCCT AGAAACAGGA CCTAAGAAAA CAAGCTACGC CGAAGGGGAG GATTTGGACC	3180
TTAGAGGTGG TGTTCTTCGA GTTCAGTATG AAGGAGGAAC TGAGGACGAA CTCATTGCGC	3240
TAACTCACGC AGGTGTATCA GTATCAGGTT TTGATACGCA TCATAAGGGA GAACAGAATC	3300
TTACTCTCCA ATATTTGGGA CAACCGGTAA ATGCTAATTT GTCAGTGAAT GTCAGTGGCC	3360

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AAGACGAAGC AAGTCCGAAA ACTATTTTGG GAATTGAAGT AAGTCAGGAA CCGAAAAAAG	3420
ATTACCTAGT TGGTGATAGC TTAGACTTGT CTGAAGGACG CTTTGCAAGT GCTTATAGCA	3480
ATGACACCAT GGAAGAACAT TCCTTTACTG ATGAGGGAGT TGAAATTCTT GGTACGATG	3540
CTCAAAAGAC TGGTCGTCAA ACCTTGACGC TTCATTACCA AGGCCATGAA GTTAGCTTTG	3600
ATGTTTGGT ATTCCTAAAA GCAGCATTGA ACGATGAGTA CCTCAACAA AAATTAGCAG	3660
AAGTTGAAGC TGCTAAGAAC AAGGTGGTCT ATAACCTTGC TTCATCAGAA GTAAAAGAAG	3720
CCTTCTTGAA AGCAATTGAA GCGGCCGAAC AAGTGTGAA AGACCATGAA ACTAGCACCC	3780
AAGATCAAGT CAATGACCGA CTTAATAAAT TGACAGAAGC TCATAAAGCT CTGAATGGTC	3840
AAGAGAAATT TACGGAAGAA AAGACAGAGC TTGATCGCTT AACAGGTGAG GTTCAAGAAC	3900
TCTTGGCTGC CAAACCAAAC CATCTTCAG GTTCTGCCCT AGCTCCGCTT CTTGAGAAAA	3960
ACAAGGCCTT GGTGAAAAA GTAGATTGA GTCCAGAAGA GCTTACAACA GCGAAACAGA	4020
GTCTAAAAGA TCTGGTTGCT TTATTGAAAG AAGACAAGCC AGCAGTCTTT TCTGATAGTA	4080
AAACAGGTGT TGAAGTACAC TTCTCAAATA AAGAGAAGAC TGCATCAAG GGTTTGAAAG	4140
TAGAGCGTGT TCAAGCAAGT GCTGAAGAGA AGAAATACTT TGCTGGAGAA GATGCTCATG	4200
TCTTTGAAAT AGAAGGTTTG GATGAAAAAG GTCAAGATGT TGATCTCTCT TATGCTTCTA	4260
TTGTGAAAT CCCAATTGAA AAAGATAAGA AAGTTAAGAA AGTATTTTTC TTACCTGAAG	4320
GCAAAGAGGC AGTAGAATTG GCTTTTGAAC AAACGGATAG TCATGTTATC TTTACAGCAC	4380
CTCACTTTAC TCATTATGCC TTTGTTTATG AATCTGCTGA AAAACCACAA CCTGCTAAAC	4440
CAGCACCACA AAACACAGTC CTTCCTAAAC CTACTTATCA ACCGACTTCT GATCAACAAA	4500
AGGCTCCTAA ATTGGAAGTT CAAGAGGAAA AGGTTGCCTT TCATCGTCAA GAGCATGAAA	4560
ATACTGAGAT GCTAGTTGGG GAACAACGAG TCATCATACA GGGACGAGAT GGACTGTTAA	4620
GACATGTCTT TGAAGTTGAT GAAAACGGTC AGCGTCGTCT TCGTTCAACA GAAGTCATCC	4680
AAGAAGCGAT TCCAGAAATT GTTGAAATTG GAACAAAAGT AAAACAGTA CCAGCAGTAG	4740
TAGCTACACA GGA AAAACCA GCTCAAAATA CAGCAGTTAA ATCAGAAGAA GCAAGCAAAC	4800
AATTGCCAAA TACAGGAACA GCTGATGCTA ATGAAGCCCT AATAGCAGGC TTAGCCAGCC	4860
TTGGTCTTGC TAGTTTAGCC TTGACCTTGA GACGGAAGAG AGAAGATAAA GATTAAATAT	4920
CGAAAAATCT TGTGAAATCT TTCCG	4945

(2) INFORMATION FOR SEQ ID NO: 48:

- (i) SEQUENCE CHARACTERISTICS:
  - (A) LENGTH: 25002 base pairs
  - (B) TYPE: nucleic acid

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(C) STRANDEDNESS: double  
(D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 48:

GACAACTCAA GTAGCTTTT CTTATTTTGA AAAAGGAGAT CAGAGTTTAA CTATGTCAGA	60
AAAATCACAA TGGGGGTCGA AACTTGGTTT TATTCTAGCA TCTGCTGGCT GGCCATCGGG	120
CTTGGTTCCG TTTGGAAGTT TCCCTACATG ACTGCTGCTA ATGGCGGTGG AGGCTTTTTA	180
CTAATCTTTC TCATTTCCAC TATTTTAATC GGTTCCTC TCCTGCTGGC TGAGTTTGCC	240
CTTGGCCGTA GTGCTGGCGT TTCCGCTATC AAAACCTTTG GAAACTGGG CAAGAATAAC	300
AAGTACAAC TATCGGTTG GATTGGCGCC TTTGCCCTCT TTATCCTCTT ATCTTTTAC	360
AGTGTATCG GAGGATGGAT TCTAGTCTAT CTAGGTATTG AGTTTGGGAA ATTGTTCCAA	420
CTTGGTGAA CGGGTGATTA TGCTCAGTTA TTTACTTCAA TCATTTCAA TCCAGCCATT	480
GCCCTAGGAG CTCAAGCGGC CTTTATCCTA TTGAATATCT TCATGTATAC ACGTGGGGTT	540
CAAAAGGGA TTGAAAGAGC TTCGAAAGTC ATGATGCCCC TGCTCTTTAT CGTCTTTGTT	600
TTTATCATCG GTCGCTCTCT CAGTTTGCCA AATGCCATGG AAGGGGTCTT TTA CTCTCTC	660
AAACAGACT TTTCAAACT GACTAGCACT GGTCTCTCT ATGCTCTGGG ACAATCTTTC	720
TTTGCCCTCT CACTAGGGGT TACAGTCATG TTGACCTATG CTTCTTACTT AGACAAGAAA	780
ACCAATCTAG TCCAGTCAGG AATCTCCATC GTAGCCATGA ATATCTCGAT ATCCATCATG	840
GCAGGTCTAG CCATTTTCCA AGCTCGATCC CCCTTCAATA TCCAGTCTGA AGGGGGACCC	900
AGCCTGCTCT TTATCGTCTT GCCTCAACTC TTTGACAAGA TGCCTTTTGG AACCATTTTC	960
TACGTCTCTT TCCTCTTGCT CTTCTTTTTT GCGACAGTCA CTTTCTCTGT CGTGATGCTG	1020
GAAATCAATG TAGACAATAT CACCAACCAG GATAACAGCA AACGTGCCAA ATGGAGTGTT	1080
ATTTTAGGAA TTTTGACCTT TGTCTTTGGC ATTCCTTCAG CCCTATCTTA CGGTGTCATG	1140
GCGGATGTTT ACATTTTGG TAAGACCTTC TTTGACGCTA TGGACTTCTT GGTTCCTCAAT	1200
CTCCTCATGC CATTTGGAGC TCTCTACCTT TCACTTTTTA CAGGCTATAT CTTTAAAAAG	1260
GCTCTTGCAA TGGAGGAACT CCATCTCGAT GAAAGAGCAT GGAAACAAG ACTGTTCCAA	1320
GTCTGGCTCT TCCTTCTTCG TTTCTTCGTT TCGTCATPCC AATCATCATC ATTGTGGTCT	1380
TCATTGCCCA ATTTATGTAA TCAAAAAGGA CTTGAGTAGT GAACTCAGGC CCTTCTTTTT	1440
TATGGATGGC TAACAATCAA TTCCAAACCT TGCCCTTCCA GAGTCCAAGC TTCAACATCA	1500
CTTGGTAGGA TAAAGTGCGT GCCTTTTGA ATTGGATAAT TTTTCCCGTC AACAGTTAGC	1560

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TGACCTTGAC CAGCCAAGAC ACTCAATAAG CTGTAGTCAG CTGTCTTTTC AAAGTCAACT	1620
TTTCCAGTAA TTTCCCACTT GTAAACTGCG AAGAAATCAT TAGATACAAG GAGAGTGGAA	1680
CGCAAATCAT CTGCTTTAAC AGTTACAGGA CGGCTATTTG CTGGCTCACC AATGTTCAAG	1740
ACATCGATGG ATTTTTC AAG ATGAAGTTCA CGCAAGTTGC CTTTGTATC CTTGCGGTCA	1800
AAGTCATAGA CGCGATAGGT GGTATCGCTA GACTGCTGGG TTTC AAGGAT TAAGTACCC	1860
GCCCCGATAG CGTGATAGT CCCGCTTGGT ACATAGAAGA AATCTCCAGC CTTAACAGGG	1920
ACTTTGGTCA ACAAGTCATC CCAGTTCTTG TCCTCGATTT GCTGGCGGAG TTCTTCTTTT	1980
GACTTGGCAT TGTGACCGTA GATAATCTCT GAACCTTCAT CCGCTGCGAT AATGTACCAG	2040
CATTCTGTTT TTCCGAGTTC GCCTTCATGC TCGAGTCCAT AAGCATCGTC TGGGTGAAC	2100
TGGACACTGA GCCAGTCGTT GGCATCGAGG ATCTTGGTCA AAAGTGGAAA TACAGGTTCT	2160
GGACGATTGC CAAATAATTC ACGGTGTTCC GCATACAAAG TAGCAAGATC TGTTCCTCG	2220
TAACGACCAT TGGCAACTTT AGAGACTCCA TTTGGATGGG CTGAGATGGC CCAATATTCT	2280
CCGATTTTTT CACTTGGGAT GTCGTAGCCA AACTCATCAC GTAGCTTGGC TCCACCCAG	2340
ATTTTTTCTT GCATAACTGA TTGTAAAAAT AATGGTTCTG ACATGTCGAT CTCCTGCTG	2400
ATTTTTCTCC CCTCATTATA GCAAAAAAAG AGTTCGAATT GAACTCTTTT TTACATCTTA	2460
TAAAGCAGGG AGAAGATTTT ATAAAAATAG TAAACAAATG TGCTCTACCC GATGCTTGCA	2520
CCATGTCTAT AAATGACATC CTTGTACCAA TAGAAGGACT TCTTCTTGCT ACGTTTGAGA	2580
GCTCCGTTTC CTACATTATC TCGATCTACA TAGATAAAGC CATAGCGCTT ATTCATTTCC	2640
CCTGTGCCAG CTGAAACCGG ATCGATACAG CCCCAGTCG TATAACCAAG CAAGTCAACC	2700
CCGTCTTGGT AAATGGCATC TCGCATGGCC TTGATGTGGG CCTCTAAGTA AGTAATCCGA	2760
TAGTCATCTG CTACATAACC ATTCTCATCC GGTGTATCCA TAGCACCGAG TCCATTTTCT	2820
ACGATAATAC TAAACTAAAA TCAAAAAGCA TTATATAATA GTGATATGAA ATCAACTAAA	2880
GAAGAAATCC AAACCATCAA AACACTTTTA AAAGACTCTC GTACAGCTAA ATATCATATA	2940
CGCCTTCAAA TCGTTCTATA GTAAATGAA ATAAGAACAG TACAAATCGA TCAGGACAGT	3000
CAAATCGATT TCTAACAATG TTTTAGAAGT AGGGGTGTAC TATTCTAGTT TCAATCTACT	3060
ATATTTCTGTC TGATGGGCAA ATCTTATAAA GAGATTATAG AACTTTTATA GTAGTTTGAA	3120
ATAAGATGTG AACAACTCTA TCAGGAAAGT CAAATTAATT TATAGAAATA TTTTAGCAGC	3180
CAAGGTGTAC TGTTATAGAT TCAATACACT ATAGACTGTA ATCAAACAAC GATTGCGCA	3240
AATGTAAAAA AATATGAGGA GTTCGGACTC GACTCTCTCC TTCAAGAAAC ACGTGGTGGT	3300
CGTAACCATG CATATATGAC AGTTGAGGAA GAGAAAGCCT TTCTTGCCCG CCATTTGAAG	3360



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GCTACAGAGG CAGGAGAATT TGTACAATT GATGCCTTAT TTCAGGCTTA TAAAAAGGAG	3420
TTAGGTCGTT CCTACACACG TGATGCCTTC TATCAACTGT TGAAGCGCCA TGGTTGGCGA	3480
AATATTACGC CACGTCCAGA ACATCCTAAG AAAGCAGACG CTCAAACCAT TGTTCGGTCT	3540
AAAAATAAAA TCTCAATCCA AGAAGGCAAG AAAGCGTTTT AAATATAGTA GACGTTTTCG	3600
TAAGGTTTGC TTGATGTACC AAGCTGAAGC TGGTTTCGGT AGAATCAGTA AACTGGGATC	3660
TTGTTGGGCT CCAATAGGAG TAGGTCCACA TATCCATAGT CACTATATAC GAGAATTTCTG	3720
CTATTGTTAT GGAGCTGTTG ATGCCTATAC AGGCGAATCA TTTTCTTAA TAGCTGGTAG	3780
ATGTAATACT GAGTGGATGA ACGCCTTTTT AGAAGAGCTT TCACAAGCTT ATCCTTTTAC	3840
TCGTTATGGA CAATGCTATA TGGCATAAAT CAAGTACCTT AAAGATTCCG ACTAATATTG	3900
GTTTTGCATT TATTCCTCCA TACACACCAG AGATGAACCC CATTTGAACAA GTGTGGAAAG	3960
AGATTTCGTAA ACGTGGATT T AAGAATAAAG CCTTTCGAAT TTTGGAAGAT GTCATGAATC	4020
AACTCCAAGA TGCATACAA GGATTGGAGA AGGAGGTGAT AAAGTCCATC GTTAATCGGA	4080
GATGGACTAG AATGCTTTTT GAAAGCAGAT GAGTATTATA TGCAATTTCT TTATATAAAA	4140
AGACCGGATT GCTCCGATCT TTCAATAGTT CATATTCTCA ATTTCTATTT TAAAAATAGC	4200
TAAGGTTAAC GTCAAATGAC TACGCGACCT ATTTTCATACG ATAAAAATCA AGCACTAGAC	4260
CAGCAGGTCC TTGAACTAAT AAGGACTCTG TTCCCAATC GGTACAGTT GGTCCGTGTA	4320
AAACCTTTAT ACCAAGCTCG TTCAACCGTT TGTAGTTCTG GTCTACATCC TCAACCTCGA	4380
TATGAATAAT GATTCTGAC TGAAAGTTTT CCAAAGGAAC CAAATGATTT TGTGACAACA	4440
TAAGGCAGTG ACTACCAATC GTAAACTGAG CAAAACCATC ATTAGCATAA TCTGCCTTTT	4500
TATCCAAGAT ATGCTCCAAG TCAGCACAGA CTTGGGGAAC ATTTGAAACG ATAATATCTA	4560
ATTGATTTAA ATTCATTTAC TCTCCTCCAT AAAAAGACCG GATTGCTCCG ATCTTTTAAA	4620
GTCTGCTCT ATGAAAATCA AAGAATAAAG TCTACAAGTT TCATATTTGA TTTTCGGCGA	4680
GAGGAATTAT TTAATGCGC GTGATTGCAA TCCTTCTTCT TCCAAGAAGA GACGGAATGG	4740
TACGAGTTCT TCTGCTTCGT ATTTTTCCTT GAAGGCTTTG ATAGCTTCTT CTGAGTGAAG	4800
TTTTGGATCC AATTCAAGTA CTTCTACTGG AAGTGGACGG TGTGAGTGA TGCGASCATC	4860
GATGACAACA GTTTTACCTT CTTTGTTCAA TTAAACAGCT TCTGCAACAA CTGCATCGAT	4920
GTCTTCGATA CGGTCAACTG TGAATCCAAC AGCTCCTTGA GCTTCCGCAA TTTTAGCGTA	4980
GTCAGCGTTT GTGAAGTCTA CACCAAACAA GTGTTTGT TTGTATCTCGT ATTTGTTCTT	5040
GATGAAGCCG TACTCAGCAT TTGAGAAGAC AAGGTTGATA ACTGGAAGGT CGTATTGAAC	5100

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GTTTGTGATA ACGTCTGGGT AGCACATGTT GAATGCTCCG TCACCCATGA TGTTCATAC	5160
TTGGCGATCT GGATTGTCTT TCTTAGCAGC GATACCACCA GGAAGGGCAA TACCCATTGT	5220
CGCAAAGAGT GGAGATGTAC GCCACATGTT CTTAGGTGTC ATGTGAAGGT GACGAGTAGA	5280
TGTTTGAGTA GTGTTACCTA CGTCGATTGA GTAGATAGCG TCTTGATCAG CATGTTTGTT	5340
GATTGCATTG TAAACTTGAT ACAATTGCAA TTCACCTCA GTTTTACCTT CGAGTTTGTT	5400
CATGTAATCA CGCCAGTTTT GGTGTCTCTT AACGTTTGCA CGCCACCATG GAGTTGATTC	5460
AACTGGGTTT ACTTGTCAA GGATAGCTTT AGCTGCTTGA CCAGCATCAC CAAGGATTGA	5520
AGCGTCAAGG GCATGACGTT TACCAAGTTT GTAAGGGTCG ATATCGACTT GGATGAATTT	5580
TTCAGTGTTT TGAATGCTT CGTAACTTC AGCAAATGGG AAGTTTGAAC CAAGGAAAAG	5640
AACTGTGTCT GCTTCAAAGA CCACCTCGTT GGCTGGTTTC CAACCAACAC GGTAAGCAGA	5700
ACCTGTCAA CCTTCATAGT TCCATTGAA AGCTTCAAAG TTTTACCAG TTGTGATGAT	5760
TGGTGCTTTG ATTTTACGTG ACAATTCAGT AATCACTTCA CCAGCTTAA CACCACCAA	5820
TCCAGCATAG ATAAGTGGC GTTCAGCATT GTTCAAGATT TCAACAGCTT TGTGATTTT	5880
AACTTCGTTT AAAGCAGGAG CGATGAATGA GCGTTCGTAT GAACCTGAAC CGTAGTATGA	5940
GTTTTCATCG ATTTCTTGA AACCAGGTT TACTGGAATT TCAACAACAG CTGGACCTTT	6000
TTTAGAACT GCAGCAGGC AGGCTTCGTC AATTACTTTT GGCAATTGCT CAGCGTAAGC	6060
TACACGTTTG TTGTAACAG CGATACCGTT GTACATTGGG TTTTGGTTAA GCTCTTGAA	6120
AGCATCCATG TTCAATTCGT TAACTGGACG TGATCCAAGG ATCGCTAGGA ATGGAGTGTT	6180
ATCCATAGCT GCATCGTAAA CACCGTTAAT CAAGTGAGTC GCACCTGGAC CACCTGAACC	6240
AACTGCAACC CCGATTGAGC CGCCGAATTT AGCTTGCTATA ACCGCTGCAA GAGCACCTGT	6300
CTCTTCGTGG CGAACTTGTA AGAAACGGAT ATCTTTGTCT TCAGCCAAAG CGTCCATCAA	6360
TGAGCTGAGT GTTCTGTAGT GGATACCGTA GATTGTATCT ACGCCCCATG TTTTCAATAC	6420
GTTAAGCATT GCTGCAGATG CAGTAATTTT CCCTTGAGTC ATAATGATAA CTCTCCTTCA	6480
ATTTTTTAA ACTTGAGAA TACGATTACA TAGAATTGGA AACGTTCTCC AAATTTTAC	6540
TATTCACCTG TATCATATTT ATGCTGACTT TTCTAAAAAT CTGCTCAAAA CTCTCTATTC	6600
TCTATTCTAA TACAGTTTGT AAAGTTCTGT CATTTCTGTT TTATAACAAA GAAATCTAGT	6660
CATTACTTTT AGTCTATTTT ACTAAAATTT AACAGAAGGG AACTGGTCAG AACAGATACA	6720
GAACTAAAGG CCATGGCTAG ACCTGCCAAT TCTGGGTTGA GAGCCAGTCC AACACCTGAA	6780
AAGACTCCTG CTGCAATCGG AATTCCGACA ACATTGTAGA TAAAAGCCCA GAAAAGATTG	6840
AGTAGAATTC GATGAAAGGT TTTCTTACTC ATATCAAAGG CACGAACCAC TCCTAAAAGA	6900

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TTATTGGTTG TCAACACCAA ATCTGCTGAC TCGATGGCGA TATCTGTTCC AGCTCCCAT	6960
GCAATCCCCA CATCTGTAC ACTAAGGGCA GGAGCGTCAT TGATACCGTC CCCAACAAAG	7020
GCTACTTTCC CTGACTGTTG CAGTTTATGG ATTTCATGGG CTTTTCTTC TGGCAAGACG	7080
CCTGCAATGA CCTCTTCAAT TCCGATTGTA TCTGCAATAG CACGCGCCAC ACCAGCATTG	7140
TCTCCTGTCA GCATGACTGT TCGGAGACCA CGTTTTTTTA GCTGACTGAT GGCTAGCTTA	7200
GCATTTTCCT TAGGAATATC TTGCAAAGCA AGCAAGCCTT TGATTTCATT GTCAACAGCT	7260
AAGAACACAA CTGTCTTAGC TTCTTTTCT AGTTCTTCTA GTTTATCTTG ATAAGTATTA	7320
GAAATATCCA TGCCATCCAG CATTTTAGCA TTTCCAAGTA AAAGTTGTTT TCCATTGATT	7380
CGCCCTGAAA CACCTTTCCC GTGCAAGGAC TGAAAAATTT CAACAGTTTG AAAGTCAAGT	7440
CCAGCTTCAC TCGCTCGCTT AACGATAGCC TCAGCCAGTG GGTGTTGAGA AGCATCTTCC	7500
AAGGAGGCTG CCAACCCAAA CACTTCTACT TCGTCGCCGA TGACATCTGT TACCACAGGT	7560
TTCCCTTCCG TCAAAGTCCC GGTCTTATCA AAGACAAGGG TTTGAAGTTT CTGGATTTC	7620
TGTAAGACAG TTCCATTTTT GAGGAGAACC CCCATCTTGG CACTACGTCC TGTCCTCACC	7680
ATAAGGGCTG TCGGTGTGTC AAGTCCCAAG GCACAAGGAC AGGCGATAAT CAAAACCGCC	7740
ACTCCGTAGA GAAGAGAGGA CACAAAGCTA GCTCCAAGCA CAACCACACT ATCCCTGAGC	7800
AAGACGAACC AAACCCAAAA GGTCTATGTT CCTAAAATGA CAACTACTGG GACAAAAATC	7860
CCTGAAATCT TATCCGTCAA GTCTGTAATC GCGCACGAC TGTCTGAGC TTTCTTCACA	7920
AAATCCACAA TCTGAGCCAA AACAGTCTCT GAGCCAAGTT TTTCTGCTCT AAAGACAAGC	7980
GTTCCACTAT GATTGATGGT TGAGCCAATG ACAGTATCTC CAACTGTCTT GTCCACAGGC	8040
AGACTCTCAC CTGTCACCAT GGATTCTGCA ATACTAGAGA CACCTTCTAC TACGACACCA	8100
TCAACAGCAA TCTTTTCACC GGGACGCACT CGAATCAGGT CGCCTACCTT GACTTGTTC	8160
AAAGGAAGTT GGACATAACT ATCATCACTC AAGACTTCTG CGGTTTTAGC TTGCAAGTCC	8220
AGTAATTTCT CCACAGCTTG GGACGTATTT TTTCTCATTT TTTCTTCAA AACTGCTCCC	8280
AAAAGAACGA AAAAGAGGAT AAATCCAGCA CTTTCGAAGT AAACAGGGAG ACCAGCAAAG	8340
AGAGCAACTA GGCTATAGAA ATAAGCCACT AGAGTTCCCA GCGCAACCAA GGTATCCATG	8400
TTGGCATTTG GCTTTTAAA ACTGGCCCAA GCACTCTGGA TATATGGCTT ACCTGCAACT	8460
AACATAATAG GCGTTGTGTC TAGAAAGGTT CCCCAGTGA TGACTTGATG ACTAATGCTA	8520
CCTGTCAACA TCCCAATCAT GAGAATCACA AGAGGCACAG TAAAGATACT AGTAATCCAA	8580
AAACGTTGCA GGAGAGATAG AGATTTTCGA GTCTTCTCAA CGACTGTATA GCTTCCCTTT	8640

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TGCATCTTCA TGCCACAAGA AAATTCATGT CGCCCTAATT CTTGAGGCGT AAAACGAATG	8700
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